THE

AMERICAN JOURNAL

OF THE MEDICAL SCIENCES.

APRIL, 1910.

ORIGINAL ARTICLES.

CERTAIN VASOMOTOR, SENSORY, AND MUSCULAR PHENOMENA ASSOCIATED WITH CERVICAL RIB.

By William Osler, M.D., F.R.S.,

REGIUS PROFESSOR OF MEDICINE, OXFORD UNIVERSITY, ENGLAND.

The symptoms of cervical rib have attracted much attention of late years, and are discussed in the exhaustive papers of Keen,[1] Thorburn,[2] and Lewis Jones.[3] The nervous and muscular features are those which most often attract attention. Last year I saw two remarkable cases, one of which threw light on a very inexplicable condition of the arm, which I had described years ago.

Mrs. L., aged thirty-one years, a strong, healthy woman, was referred to me by Dr. Andrew, of Thame. There was nothing special in her family or personal history. For ten or twelve years she had noticed a pulsation above the clavicle on both sides, most marked on the left; the physicians who first saw her suggested the possibility of an aneurysm. What has troubled her of late has been that after using the left arm for a short time there is a sensation of numbness, sometimes of "pins and needles," and if she continues to work, the skin gets red, and the arm feels swollen and hot; then in a little while she is quite unable to use the arm, and even has dropped things from her hand. The condition has increased very much of late, and it is for this that I was consulted. When quiet and at rest the arm feels natural, and she can do the ordinary work with her fingers. It is only when she attempts to use the arm that

[1] Amer. Jour. Med. Sci., 1907, cxxxiii, 173.
[2] Med.-Chirurg. Society's Trans., 1905.
[3] Quarterly Jour. Med., vol. i.

numbness and tingling begin; then if she persists, redness and swelling follow, and finally she has to give up work. She has become nervous about it, and two months ago she appears to have had an attack of unusual severity, in which she fainted.

She was a very healthy looking woman with high color, no cyanosis; the radial pulses were equal; above the clavicles there was pulsation, somewhat more forcible on the left side on which it extended from the outer end of the clavicle upward and inward toward the thyroid. It was very noticeable, and one was not surprised that it had been regarded as aneurysmal. There was no pulsation to be seen in the sternal notch. After exertion, and in the erect posture, the left supraclavicular space looked fuller than the right, and a marked pulsation occupied the whole of the lower triangle. On palpation, no definite tumor could be felt, nor could one grasp a vessel between the fingers, and yet the pulsation was marked and distinctly arterial. The swelling was a little tender; on deep pressure one felt a resistance suggestive of a cervical rib. On auscultation, there was a systolic murmur over the vessel on the left side, none on the right. The left arm looked smaller than the right. There was no wasting of the muscles of the hand. Sensation was everywhere perfect. After moving the arm up and down, and working the muscles, she complained that the skin felt prickly and numb, and a flush extended over it, but no swelling followed. This, she says, only comes on if she persists in using the arm. The heart's impulse was a little forcible, but the sounds were loud and clear. Dr. Sankey took an *x*-ray picture, which showed well-marked cervical ribs on both sides, curiously enough, the larger one on the right.

The special point of interest about this case to me was the explanation it offered of two very remarkable cases, one of which I showed at the Philadelphia Neurological Society.[4] I give here a brief abstract: A man, aged forty-eight years, always very healthy and strong, a carpenter by occupation, complained of inability to use the right arm, which had been gradually coming on for some time. When at rest and quiet, it felt perfectly natural, and all the ordinary actions of life could be done without discomfort. There was no pain, no numbness or tingling, and the hand and arm looked natural; but when he worked, or used the right arm for more than a few minutes, he began to feel an unpleasant sensation and numbness and great tenderness; the color of the skin changed, and the whole arm became congested and swollen. This would occur in a very few minutes, and the veins would stand out with great prominence. There was a general dusky lividity of the skin. If the exercises were continued, the arm became visibly swollen. At rest, the circumference of the thickest part of the forearm was eleven inches, after exertion twelve and one-half inches. At rest, the radial pulse

[4] Jour. Nerv. and Ment. Dis., 1888. p. 248.

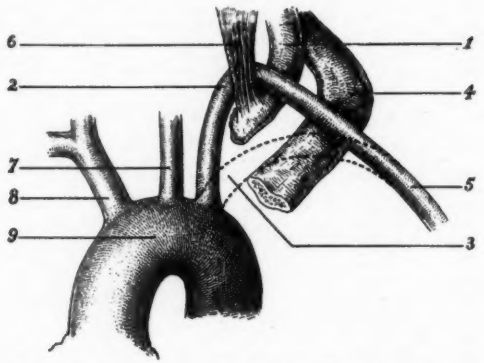
on the two sides seemed normal and equal; after exertion the right radial became very small, only just perceptible. When the arm was held up above the head, the congestion and swelling rapidly disappeared. Nothing whatever could be felt in the axilla, or in the course of the bloodvessels. I saw this patient at intervals of six months longer; he could do no heavy work, but all ordinary minor actions could be done without any swelling of the arm. The case was one that excited a good deal of interest, but no very satisfactory explanation could be offered. Unfortunately we did not at that time appreciate the importance of cervical rib, which I do not doubt was the cause of the remarkable disturbance in this case.

The other case was a woman, aged thirty-eight years, who came to my out-patient clinic at the Johns Hopkins Hospital, complaining of redness, pain, and stiffness of the right arm on exertion. At rest, the arm looked natural, but when used for ten or fifteen minutes there was a remarkable change—the skin became flushed, the fingers slightly cyanotic, and she complained of a feeling of stiffness with numbness and tingling, and if she continued to work the hand, the forearm became swollen and so stiff that she had to stop. There was no disturbance of sensation, no atrophy of the small muscles; the pulses were equal; there was nothing to be made out in the chest, or in the course of the arteries. I suspected at first pressure of glands high in the axilla, but nothing could be determined by the most careful examination. I did not think of cervical rib. The condition had persisted at intervals for several years and was the cause of great disability, as she could not work continuously for any length of time. If she did not use the arm there was no inconvenience.

In both these cases the symptoms, though more aggravated, were identical with those complained of by Mrs. L., and I have no doubt that, could we have taken *x*-ray pictures, cervical ribs would have been found. In Keen's paper several cases are reported in which the hand and forearm became livid and swollen. But it seems probable that there is a special group in which the symptoms come on only after exertion, and they resemble closely the condition known as intermittent claudication. In many cases the subclavian artery has been compressed in the angle between the rib and the scalenus anticus. When at rest, and with very slight muscular effort, enough blood reaches the limb, but the demand for more blood which follows exertion is not met, and there is stiffness and numbness with vascular changes. So marked may these latter be, that there are cases reported suggesting Raynaud's disease, and Keen states that in at least seven instances local gangrene has followed.

An important suspicion was raised in this case as to the existence of aneurysm. As Keen remarks: "On the whole, the evidences of true aneurysm in most of the cases in which it has been reported are,

to my mind, by no means always convincing. Usually the diagnosis has been based on the strong pulsation, sometimes with bruit and thrill. In a few cases, as in my own, the artery has been found, at operation, moderately enlarged, or in one case (Murphy's) flattened. In several cases operation has, therefore, disproved the presence of the supposed aneurysm. The postmortem in Adam's case disclosed a cylindrical aneurysm. Bearing upon the history of pressure or tension of the artery as it crosses the cervical rib, it is significant in Fischer's (Braun's) case that when the arm hung down (pressure or tension) a bruit was present, and when it was held up (relief of pressure) the bruit disappeared."



Scheme to show the changed course and the consequent angulation of the subclavian artery when it passes over a cervical rib. The dotted line (3) represents the normal gentle curve of the artery. 1. Cervical rib. 2. Subclavian artery passing over the cervical rib. Note its high position, its angulation, and the likelihood of pressure by the scalenus anticus 6. 4. First dorsal rib. 5. Axillary artery. 7. Left carotid. 8. Innominate. 9. Aortic arch. (Keen.)

But unquestionably, in a few cases, dilatation of the vessel, a cylindrical aneurysm, or even a sacculated tumor, has been present. In the case here reported, though the pulsation was diffuse and suggestive, there was no evidence of aneurysmal dilatation. To the Infirmary for Nervous Diseases, Philadelphia, Rose D., aged nineteen years, an inmate of the Pennsylvania Blind Asylum, was brought for a supposed aneurysm of the subclavian. There were the local paralysis and atrophy which one now recognizes readily enough as characteristic of cervical rib. Over this, no doubt, the subclavian artery was hooked, as in Keen's diagram, which I here reproduce, as it shows this angulation and elevation. It explains the position of the swelling in these cases, and the high pulsation. In the case of the blind girl just referred to the swelling in the supraclavicular region was marked, and while the mass itself did not pulsate, the vessel could be readily traced, and there was a loud murmur heard along its course.

THE FUNCTIONS OF THE PITUITARY BODY.[1]

By Harvey Cushing, M.D.,
ASSOCIATE PROFESSOR OF SURGERY IN THE JOHNS HOPKINS UNIVERSITY, BALTIMORE.

Information in regard to the physiological properties of one of the glandular bodies whose secretion supposedly enters directly into the bloodstream may be gathered in numerous ways: (1) We may observe the immediate consequences of injecting its variously prepared extracts, or we may more accurately attempt to simulate the action of the hyperfunctionating gland by repeated injections, by feeding, or by implantations. (2) We may, on the other hand, study the reverse conditions comparable to lowered glandular activity by observing the effects of total or partial destruction or extirpation. (3) We may approach the subject in a roundabout way by observing the alterations in its histological appearance and activity which follow the removal or injury of one or another of the allied or interrelated glandular structures. (4) We may gain some further insight into its function by the changes which occur not only in conditions of disease, but also during certain unusual physiological states, such as pregnancy, hibernation, puberty, and the menopause.

Let us consider *seriatim*, certain of the facts which these several methods have disclosed in regard to the functions of the hypophysis—facts which are merely steps toward the ultimate goal of determining the chemical nature of the active principle or principles to which it owes its activities.

1. Simulated Oversecretion by Injections, Feeding, etc. Through the interest aroused in the possible importance of the pituitary body as an active organ which followed Marie's early papers, studies by injection methods were made at various hands. As is well known, it was shown by Oliver and Schäfer that the glandular extract, even when raised to the boiling point, led to a rise in blood pressure, and later by Howell that this substance was confined to the posterior lobe of the gland—the pars nervosa and its epithelial investment. The pressor response following this primary injection was found to be more enduring than that produced by adrenalin and to be accompanied by a definite slowing of the pulse, which occurs even when the vagi are cut or atropine is used. Even on the first injection, however, there may be an initial depressor reaction, and this, on subsequent injections, may be the only response. It was subsequently brought out by Schäfer and Magnus that this active principle of the posterior lobe distends

[1] Read at the combined session of the American Physiological Society and Section K of the American Association for the Advancement of Science, Boston, December 28, 1909.

the kidneys and increases the flow of urine. It shows a further resemblance to adrenalin in dilating the pupil; and similar atheromatous changes in the arteries are said to follow the long-continued administration of either extract.

These responses to extracts of glands of lower animals have recently been shown by Halliburton, Candler, and Sikes[2] to hold true for extracts of the human gland, and, using Baumann's method for the detection of iodine, they have made the important observation that the hypophysis, though capable of secreting colloid, differs form the thyroid gland in being iodine free.

All similar physiological reactions have proved negative so far as the injection of anterior lobe extract is concerned. We have occasionally observed a slight pressor effect in partially thyroidectomized animals, but we have found that the most striking consequence of anterior lobe injection occurs as a thermic response in animals suffering from hypopituitarism, a rise of 2° to 4° C. in body temperature being not unusual.

With Dr. S. J. Crowe, the attempt has been made to study the effects upon nutrition of repeated injections, and it is our experience, in partial agreement with others, that the extract of the entire gland, or of the posterior lobe alone, administered daily over long periods of time, leads to progressive emaciation, often with marked degenerative changes in the spleen and central necroses in the liver. Similar evidences of autointoxication, it may be added, we have not uncommonly seen after operative removal of the gland.

No conclusive results were obtained by repeated daily hypodermic administration of anterior lobe extract in the several puppies subjected to this treatment. They rather tended to lose weight than otherwise, and this has been the experience of Caselli and others. Possibly in these investigations too large an amount of extract has been introduced, or some pars intermedia may have been included in the preparation. Likewise anterior lobe injections in animals in the cachexia hypophyseopriva stage failed in any striking way to postpone the outcome of a total hypophysectomy, though we have been somewhat more successful in tiding over this critical condition by heterotransplants placed in the cerebral subcortex.[3]

The necessity of clearly distinguishing between the properties of anterior and posterior lobes becomes very apparent in all of these observations. And this is no less true for the proper interpretation of the results of feeding experiments. Ingestion of the entire pituitary, as was shown by the experiments of Thompson and Johnston,[4] leads to a loss of weight by stimulating metabolism,

[2] Quarterly Journal of Experimental Physiology, 1909, ii, 229.

[3] Crowe, Cushing, and Homans, Quarterly Journal of Experimental Physiology, 1909, ii, 389.

[4] Journal of Physiology, 1905, xxxiii, 189.

an effect which in all probability can be attributed to the inclusion of the posterior lobe extract in the preparation which they employed.

Sandri[5] observed no effect upon the growth of young mice from a two months' feeding of the pars anterior of beef pituitary, whereas those similarly fed on posterior lobe substance showed a notable arrest of development. Positive results, however, have recently been obtained by Schäfer,[6] who found that the growth measurements in a series of white rats fed upon powdered anterior lobe showed a definite increase over the controls; and certain observations, at present being conducted by Dr. Emil Goetsch in the Hunterian Laboratory, tend to give support to Schäfer's observations, at least so far as the effects of anterior lobe feeding on the body weight and growth of partially hypophysectomized puppies is concerned.

As is true of other ductless glands, the effort to increase secretion by the ingrafting of heterotransplants, whether in spleen, bone-marrow, or elsewhere, has been disappointing, for, on the principle elucidated by W. S. Halsted, it appears that transplants "take" only when there is some physiological glandular deficiency; hence it is impossible to study the consequences of hypersecretion in this way.

Injection and feeding experiments therefore show: (1) That in the posterior lobe or its epithelial investment is a substance which raises blood pressure, dilates the pupil, causes diuresis, and, when given subcutaneously or injected over long periods of time, is likely to produce marked nutritional disturbances; and (2) that ingestion of the anterior lobe, at least in the case of young animals, appears to have some influence in stimulating growth, and that injection of its extract in states of hypopituitarism leads to a temporary pyrexia.

2. Simulated Undersecretion by Total or Partial Destruction or Removal of the Gland. Attempts at surgical removal have been made by various operative methods on various animal species and with seemingly variable results—to be explained doubtless by incomplete extirpation and the failure to control the surgical procedure by a careful examination of the infundibular region in serial sections in order to exclude the possibility that viable fragments have been left behind. Sir Victor Horsley's original statement, based on the supposedly total hypophysectomy in two dogs, that no disturbance follows the loss of the gland, has been given wide credence, and subsequent observations by Marienesco, Vassale, Fichera, Gley, and many others have not been sufficiently conclusive to modify this generally accepted view.

Paulesco, of Bucarest, however, in 1908, using an improved

[5] Riv. di Path. Nerv. e Mentale, 1908, xiii, 518.
[6] Croonian Lecture, Proceedings of the Royal Society, 1909, lxxxi, 442.

surgical approach to the base of the brain, succeeded in removing the gland in its entirety from 22 dogs and 12 cats, and found that its loss leads to a peculiar train of symptoms invariably followed by death in the course of two or three days.[7] In all of the animals which survived, viable fragments of the anterior lobe were invariably found postmortem at the base of the brain. He furthermore was led to believe that the mere separation of the stalk was comparable to a total hypophysectomy.

Since the publication of these observations in 1908 an article by Gemelli,[8] of Milan, has appeared, criticizing Paulesco's operative method and recording a series of operations on cats by an intrabuccal approach, with contrary results. Following Gemelli's procedure a number of these animals were operated upon a year ago in the Hunterian Laboratory by Dr. John Homans, and symptoms, in every way comparable to those observed in the canine, followed all complete extirpations.

It can be appreciated that observations of this kind, requiring not only an elaborate and delicate operation, but a thorough histological postmortem examination, not only of the other ductless glands, but of the infundibular region by serial sections, are not a light undertaking, and the histological corroboration of the operative results were neglected in the fifteen experiments carried out with Dr. L. L. Reford in 1908.[9] During the past year, in collaboration with Drs. S. J. Crowe and John Homans, a series of a hundred hypophysectomies was made the object of a more thorough investigation, the detailed report of which is forthcoming. These observations lend further support to Paulesco's main contention as regards the consequences of a total hypophysectomy, but they have brought out the fact that not only is the operation much more easily conducted in young than in adult animals, but also that the acute symptoms of cachexia hypophysepriva do not set in in puppies until a period varying from ten days to three weeks after the operation. They have shown also that a stalk separation need not be fatal, for the epithelial lobe need not lose its vitality and the gland may become reattached in a nearly normal physiological relation to the infundibulum. Loss of the posterior lobe, furthermore, leads to no obvious disturbances in the animal's condition, whereas removal of the anterior or epithelial lobe—the posterior lobe remaining *in situ*—is equivalent to a total hypophysectomy.

The symptoms of cachexia hypophyseopriva are unmistakable, and, as has been indicated, set in after a variable period of from thirty-six hours to two weeks or so after the operation, depending upon the age of the animal. With the exception possibly of a

[7] N. C. Paulesco, L'hypophyse du cerveau, Vigot Frères, Paris, 1908.

[8] Folia Neurobiologica, 1908, ii, 167.

[9] Reford and Cushing, Is the Pituitary Gland Essential to the Maintenance of Life? Johns Hopkins Hospital Bulletin, 1909, xx, 105.

transient glycosuria, with or without polyuria, the animal in the interval appears perfectly normal in all respects. The onset of the symptoms is characterized by inactivity with a little stiffness and unsteadiness of gait and lowering of body temperature; an awkward arching of the back with incurvation of the tail is characteristic. In the course of a few hours or days, depending on the rapidity of progress in different ages, there is a further fall in temperature, together with slowing of pulse and respiration; and irregular muscular contractions occur, often with snapping of the jaw—coarse shivering movements which are not entirely unlike the tremors characterizing tetany. The animal becomes more and more lethargic and indifferent to his surroundings and finally lapses into an anesthetic state of coma, with slow pulse and an occasional deep diaphragmatic respiratory movement; and it is often difficult to tell just when life ends. Before this occurs the fall in temperature may have been extreme—to 20° C. or lower, almost room temperature.

In a series of hypophysectomized animals which have been observed this fall, Dr. Goetsch called attention to the fact that the heart is often found beating, or may resume its activity, when exposed post-mortem, and, like the batrachian organ, may continue to pulsate sometimes for half an hour after its removal from the body if placed in salt solution.

An examination of the other ductless glands from this series of animals has shown definite histological alterations, which are now under investigation. Some of the most striking changes have been observed in the thyroid and testis.

Our chief interest, however, has been centred in the animals who have survived the operation for long periods and in whom a postmortem examination has invariably shown that viable fragments of the anterior lobe have been left *in situ*, whether accidentally or, as in our later series, purposefully. These partial operations may be divided into three categories: (1) Those with removal of the posterior lobe alone; (2) those with a partial loss of the anterior in addition to the posterior lobe; and (3) those with total or fractional extirpation of the anterior lobe alone.

Owing to the persistence of a well-developed cleft, the posterior lobe in the canine is readily dislocated from the rest of the gland and can be removed as an intact fragment. As I have already stated, such a partial operation leads to no apparent disturbance in the animal's condition, though it must be admitted that fragments of pars intermedia which remain viable and possibly show hypertrophy are necessarily left adherent about the infundibular stalk in even the most complete operations. In these cases we have observed no striking post-operative alteration in blood pressure or urinary secretion, such as might be expected in view of the known effects of extracts from this part of the gland. On the other

hand, in those animals which have suffered a partial loss of the anterior lobe and have subsequently been observed for a long period of time, definite nutritional disturbances have frequently occurred. Thus, in puppies a partial hypophysectomy leads to a persistence of infantilism, and though the animals are fairly lively and playful, they remain undersized, acquire no secondary sexual characteristics, show a tendency to hypotricosis, often have a subnormal temperature, and are otherwise comparable to some of the clinical conditions to be described. Feeding experiments are being undertaken in some animals of this series.

In the adult animals subjected to a partial hypophysectomy other changes have been noted which suggest a reversion to the infantile type. A number of them have in the course of a few months become exceedingly fat, suggesting the experimental reproduction of the well-recognized clinical condition which accompanies certain cases of tumor of the hypophysis unassociated with akromegaly. In several adult males, furthermore, there has been a very evident atrophy of the external genitals, the tubules of the testis showing a tendency to reversion to the infantile type with loss of spermatozoa, absence of mitosis and other peculiar changes in the spermatogenetic epithelium, as well as certain alterations in the interstitial cells of Leydig.

Histological changes are also apparent in the thyroid and islands of Langerhans, and possibly also in thymus, adrenals, and ovaries, but we cannot speak definitely of these changes at the present time.

The view is a natural one that the glycosuria, for example, seen so often not only in the clinical cases of hypophyseal disease,[10] but also in these experimental conditions, may possibly be secondary to some alteration in the pancreatic islets rather than due to the primary hypophyseal lesion; and similarly that the adiposity may be consequent upon a testicular or ovarian disturbance comparable to the adiposity which follows castration or spaying.

3. Hypophyseal Changes Secondary to Lesions of Other Ductless Glands. Of these changes I cannot speak from personal experience, though alterations in the gland secondary to castration and to thyroidectomy have been described by various writers. Thus, the gland has been found to be uniformly larger, by measurement and weight, in castrated horses than in studs, and the same is true of cattle.[11] Gley demonstrated in rabbits that the gland enlarges after experimental thyroidectomy; Stieda and Rogowitsch

[10] Borchardt estimates (Zeitschrift f. klinische Medizin, 1908, lxvi, 332) that 35 per cent. of the reported cases of akromegaly have shown glycosuria, and on the view that the glycosuria might be due to hyperactivity of the gland he injected large doses of pituitary extract into dogs and rabbits, and in the latter glycosuria constantly occurred. This he interpreted as evidence that akromegaly is due to hyperfunction. We find that a temporary glycosuria, however, is a very frequent sequel of total or partial extirpations, so that a disturbance of carbohydrate metabolism may seemingly accompany either hyper- or hypopituitarism.

[11] Schütz, Wiener med. Wochenschr., March 29, 1909, 606.

described the change as an hypertrophy of the anterior lobe, and Cimoroni has shown that it is due to the loss of thyroid rather than parathyroid tissue. Herring,[12] however, finds the chief alteration in the pars nervosa, pars intermedia, and ependymal cells of the third ventricle.

That the reverse is true, namely, alterations in other glands secondary to hypophyseal lesions, we have abundant evidence, and it is just as natural that a lesion primarily involving some other of the family of ductless glands should bring about some functional readjustment which is productive of definite gross and histological changes in the hypophysis. The close physiological interrelation of all of these bodies, as emphasized by Falta, is most probable, and many illustrations may be drawn from conditions of experiment, as well as of disease. In the case of the hypophysis, however, just what the recognizable alterations signify awaits an interpretation which can only be forthcoming when we gain a more thorough knowledge of the exact physiological properties, particularly of the various cells which comprise the epithelial portion of this gland.

4. Alterations in the Gland in Disease and in Various States of Functional Activity. Since Marie called attention to the association of akromegaly with hypophyseal tumors a number of phenomena in addition to the apparant relation of the gland to body growth have come to be recognized as frequent accompaniments of hypophyseal lesions.[13] Among these may be mentioned glycosuria, polyuria, impotence or amenorrhœa in adults, and the delayed or nonappearance of secondary sexual characteristics in the young; both of the latter conditions being oftentimes accompanied by a peculiar and occasionally an excessive degree of adiposity. Other less striking manifestations may occur, such as a subnormal temperature, hebetude, slowing of the pulse and falling out of the hair, with other cutaneous changes—all of them symptoms which, as we have seen, may appear in one or another of the experimental conditions already described.

The actual association of an hypophyseal lesion with akromegaly is by no means generally conceded, despite the obvious tumor or enlargement so frequently observed, for a number of autopsies of undoubted cases of akromegaly have shown a pituitary body which has been regarded as practically normal. Further confusion has arisen owing to the description of a group of cases by Fröhlich and others in which tumors in the infundibular neighborhood were accompanied by adiposity and infantilism in the absence of akromegaly.

[12] Quarterly Journal of Experimental Physiology, 1908, i, 28.

[13] We must clearly differentiate, of course, between the so-called neighborhood or pressure symptoms of infundibular tumors and the nutritional disturbances which are due to the direct implication of the pituitary body itself.

It is hoped that the experiments which have been briefly recounted will serve in a measure to clear away some of these obscurities, or at least establish a basis for further investigation. Doubtless an overactive gland may present but slight enlargement, or at least may show no definite tumor growth, just as hyperthyroidism need not necessarily be accompanied by any great increase in size of the thyroid gland. Certain surgical experiences in cases of akromegaly, notably a case of Hochenegg's, reported by Stumme, and a case of my own, with a measurable subsidence of the manifestations of overgrowth, suggest that this disease is actually due to overactivity of the pars anterior of the gland; and if Schäfer's recent feeding experiments are to be confirmed, they add further support to this view.

The persistence of the characteristics of infantilism in a number of our puppies subjected to a partial hypophysectomy, and the occasional evidence of secondary atrophy of the sexual organs, together with the appearance of adiposity in several of the adult animals, suggests that the cases in which an hypophyseal tumor has been found in common with symptoms of adiposity and either a persistence of sexual infantilism or a secondary sexual degeneration, point toward the lowering of hypophyseal activity as the explanation of this clinical syndrome.

Doubtless there are many border-line cases in which the symptoms are less outspoken, as is true of moderate grades of over- or under-activity of the thyroid; and it is quite probable too that some of the confusing cases of gigantism, or akromegaly, which become impotent or have amenorrhœa with more or less marked adiposity are cases in which a gland with primary functional hypertrophy has become transformed into the well-recognized malignant adenoma,[14] leading in the course of time to interruption of normal secretion with the production of symptoms which we recognize as being due to a lessening of the functional activity of the gland. In similar fashion myxœdema may replace hyperthyroidism. We have recently observed a patient with an hypophyseal tumor in whom a beginning adiposity with impotence indicated an existing state of hypopituitarism; but an *x*-ray of the hands showed unmistakable evidence of an unsuspected akromegalic change in the bones, presumably a relic of an earlier stage of the glandular disease which was accompanied by oversecretion.

This will, of course, be recognized as merely a rough working hypothesis which leaves many things unexplained, for considering these various phenomena as due to alterations of the pars anterior, it leaves the function of the posterior lobe largely out of consideration.

The epithelial investment of this lobe (*pars intermedia:* Herring)

[14] Löwenstein, Virchow's Archiv. 1907, clxxxviii.

is doubtless an important part of the gland, the function of which is not fully established, though the hemodynamic and other properties contained in extracts of this lobe are doubtless due to the secretory activity of these cells. Herring first called attention to the fact that their secretion in the form of hyaline globules, observable under the microscope, passes into the abundantly canalized tissue of the pars nervosa and could be traced upward until it emerged between the ependymal cells, to pass directly into the infundibular cavity of the ventricle. Our sections fully corroborate this observation of Herring's, and under certain conditions of experimentation we have seen the secretion greatly augmented in amount.[15]

With full acceptance of this view, therefore, it is but natural that conditions which cause a stasis of cerebrospinal fluid, such as hydrocephalus, whether of the primary or acquired type, will lead to a damming back of the secretion. This we have found to be the case. The pars nervosa is often overfilled with the hyaline globules, which may even be seen in certain sections in the infundibular cavity. Large retention cysts of colloid are often observed under these circumstances, but this material is basophilic and, so far as we have been able to tell from injections, it does not contain the active principle of the posterior lobe. It is not improbable that the hyaline globules which take an acid stain are chemically modified by their passage through the pars nervosa.

In almost all cases of brain tumor, whether associated with hydrocephalus or not, we have found morphological as well as histological evidences not only of this retention of posterior lobe secretion, but of pressure on the gland as a whole. This glandular deformation may be considerable, and varies from a slight cup-shaped depression to a scaphoid configuration of the gland, which may be compressed until it measures only two or three millimeters in thickness, with marked histological alteration in the cells, particularly those of the anterior lobe. It is not unusual for patients with either primary hydrocephalus or brain tumors to show a tendency to become adipose despite the serious nature of their underlying malady. It is well known also that amenorrhœa and impotence are common disturbances in tumor cases, and it is not improbable that these symptoms may be secondary to hypophyseal insufficiency such as we have described. This view has been advanced by Marienesco and others for conditions of hydrocephalus.[16]

[15] We have recently had the opportunity of studying the tissues from an excessively obese individual who died from the pressure effects of a large adenomatous tumor at the base of the brain. Dr. Crowe was fortunate enough, in studying a section through this growth, to discover a normal, though compressed, hypophyseal anterior lobe with undoubted evidence that the growth originated from the pars intermedia alone. The tumor resembled in its arrangement of acini containing colloid one which might have originated from the thyroid gland itself. The view has been advanced that the hypophysis may act vicariously for the thyroid, though there seems to be no justifiable grounds for this belief, as their extracts give quite contrary results, and the hypophysis, as has been stated, is iodine-free.

[16] Marienesco and Goldstein, Revue neurologique, 1909, xvii, 1000.

Before one can hope to interpret the pathological alterations of the hypophysis in disease, information is necessary in regard to its cellular appearance in different states of normal physiological activity, and this as yet has not been thoroughly acquired. There are three varieties of cells distinguishable by their variable staining reactions. The coarsely granular acidophile cells of the normal (resting ?) gland tend to lie in rows along the vascular sinuses. There occur also, in smaller numbers, large basophilic cells, while the centre of the columns or acini is filled with cells of an indifferent staining reaction—the *Hauptzellen* of the Germans. It is to be noted that the anterior lobe cells, as well as those of the pars intermedia under certain conditions (normal or pathological?), may secrete colloid, and this or a hyaline-like substance may even be seen within the blood sinuses of the gland; nevertheless, we must regard the cells of the pars anterior and the pars intermedia as differing widely in function, and there may, indeed, be more than one active principle in each division of the gland.

The coarsely granular acidophile elements were thought by Benda[17] to represent the active stage of the anterior lobe cells, a view supported later by Dean Lewis, who has made a most careful study of the histological appearances in a case of akromegaly unaccompanied by tumor. During the course of our experiments we have attempted to determine the histological characteristics of the glandular hypertrophy which would be presumed to occur in cases of survival after a partial removal of the anterior lobe, and it is our impression, from the study of these sections and from certain experiments made by Dr. Crowe upon the effect of pylocarpine administration in animals presumed to retain an active fragment of gland, that the large vesicular type of cell, largely free from granules, represents the active, or at least the discharged stage; the abundantly filled chromophile cells, on the other hand, representing a resting or storage stage which does not necessarily indicate great functional activity.

It is quite possible that Scaffidi[18] is correct in his view that the various anterior lobe cells do not represent stages of activity of one and the same cell, but that they actually have different properties. Erdheim and Stumme's recent studies of the histological alterations of the gland in pregnancy[19] might also be regarded as an argument favoring this conception, for in this condition it is the central cells (*Hauptzellen*) which appear to become active and to fill the cell columns at the expense of and with the relative disappearance of the chromophile elements, which remain few in number and instead of lining the sinuses are crowded to the centre of the columns. The distribution of these cells, as Dr. Goetsch has shown,

[17] Berliner klin. Wochenschr., 1900, xxxvii, 1205.
[18] Archiv f. microscop. Anat., 1904, lxiv, 235.
[19] Beiträge z. path. Anat. u. z. allg. Path., 1909, xlvi, 1.

is well brought out by the use of iron-hematoxylin stains, which pick out the chromophile granules in unmistakable fashion. We have had an opportunity of confirming these findings of Erdheim and Stumme's, and similar careful studies of a series of glands in other physiological states will doubtless show corresponding clean-cut alterations from the supposedly normal in the histological picture.

The weight of the hypophysis is somewhat greater in the female than the male, being slightly over 0.5 gram in the former and slightly under this weight in the latter. There is, however, a marked increase in the weight of the gravid gland, the particular specimen which we have had an opportunity of studying weighing 0.85 gram at the termination of pregnancy. The glands, on the other hand, from cases of intracranial tumor have been quite uniformly underweight.

Material taken at random from a series of indiscriminate autopsies has given us no special information of value. Through the kindness of Dr. Adolph Meyer we have had the opportunity of studying a series of 75 glands from the Worcester Hospital—a source similar to that from which Halliburton, Candler, and Sikes secured their material—and although histological alterations are present in the majority of them, it would be impossible to draw safe deductions without a thorough knowledge of the exact intracranial conditions and of correlating the findings with alterations in the ductless glands elsewhere from the same individual.

SUMMARY. It may be said that the pituitary body is a double organ in the sense that the secretion of its anterior and solidly epithelial portion discharges into the blood sinuses which traverse this part of the gland; whereas the hyaline substance, apparently the product of secretion from the epithelial investment of the posterior lobe, enters the cerebrospinal space by way of channels in the pars nervosa. Though possessing a physiologically active principle, as shown by the results of injections, the secretion of the posterior lobe does not seem to be so vitally essential to physiological equilibrium as that of the anterior lobe, the total removal of which leads to death with a peculiar train of symptoms which set in at an early date in the adult and after a longer interval in younger animals.

Alterations in the gland, which often ultimately assume the character of a malignant growth (adenoma) but which presumably, at least in their earlier stages, represent an hypertrophy, are common in clinical conditions of overgrowth (akromegaly and gigantism), and certain feeding experiments lend support to the view that these clinical states represent the consequences of hyperactivity of the pars anterior. Partial removals of the anterior lobe usually lead to obvious disturbances of metabolism accompanied oftentimes by adiposity and in the young by a persistence of infantilism, or in adults by a tendency to lose the secondary sexual characteristics

already acquired. These experimental conditions are comparable to those which have been recognized clinically as accompaniments likewise of tumors in the hypophyseal region, which under these circumstances can therefore be interpreted as lesions which through pressure have led to lessened glandular activity.

In view of the apparent interrelation of many of the glands of internal secretion it is quite probable that certain of the symptoms known to accompany hypophyseal disease may be consequent upon a secondary change in other glands which follows the primary lesion of the hypophysis. These changes are seemingly more outspoken and more widespread after a lesion of the pituitary body than after a corresponding lesion of any other individual member of the group of ductless glands, and in view of its unusually well-protected position one might have conjectured that it must represent a vitally important organ.

AN ACUTE INFECTIOUS DISEASE OF UNKNOWN ORIGIN.

A CLINICAL STUDY BASED ON 221 CASES.

By Nathan E. Brill, A.M., M.D.,

PROFESSOR OF CLINICAL MEDICINE IN THE COLLEGE OF PHYSICIANS AND SURGEONS, COLUMBIA UNIVERSITY, NEW YORK; ATTENDING PHYSICIAN TO THE MOUNT SINAI HOSPITAL, NEW YORK.

For many years great confusion prevailed about the two diseases which are now known as typhus and typhoid fever, even after clinical knowledge of these diseases had separated them from the large group of "pestilential fevers" with which they had previously been confounded. This confusion was due to the fact that, irrespective of the lack of pathological investigation and the ignorance of the causative factors of these diseases, no well systematized analysis of the clinical features of them had been carried on. At the end of the eighteenth and the beginning of the ninteenth centuries the first great work on the differentiation of typhus and typhoid fevers was begun. We owe to Prost,[1] in France, the recognition of the intestinal lesions as the important distinctive lesion of typhoid fever. Even with the great contribution of Petit and Serres,[2] who followed and elaborated on Prost's work, showing that the lesion was limited especially to the lower part of the small intestine, and of Bretonneau,[3] of Tours, that the

[1] Médecine éclairée par l'observation et l'ouverture des corps, Paris, 1804.

[2] Traité de la Fièvre Entéro-mésentérique, Paris, 1813.

[3] De la maladie, à laquelle M. Bretonneau a donné le nom de dothiénentérie, ou de dothiénertérite, Arch. gén. de méd., 1826, ser. 1, tom. x, 169. Notice sur la contagion de la dothiénentérité, Arch. gén. de méd., ser. 1, xxi; also, de la dothiénentérité, Arch. gén. de méd., 1826.

lesion was always localized in the agminated and solitary glands of the ileum, the great acumen of Louis,[4] who gave the name typhoid, and of Chomel[5] could not dissociate clinically typhus from typhoid fever. They all regarded the contagious fever of camps, of armies, and that of the English writers as identical with the disease whose lesion they so meritoriously discovered and analyzed.

Just as important as this was the work at differentiation being done in Great Britain by James Muir,[6] Edmonstone,[7] Hewett,[8] of St. George's Hospital, Bright,[9] Alison,[10] Craigie,[11] Cheyne,[12] who were able to support the findings of the French authors, but only in a limited number of the immense number of cases at their disposal. Thus, it came about that the French pathologists rarely failed to find the intestinal lesions, for they were dealing with typhoid fever cases mainly, and the English investigators, who were dealing with much the greater number of typhus fever cases, rarely found the lesion. In 1835 Peebles[13] pointed out to Perry[14] of Glasgow, the *rubeoloid* eruption of typhus which he had learned to recognize in the typhus of Italy. Perry, thereupon, in the following year in a paper, correctly described many of the differences between typhus and typhoid, and showed the absence of the rubeoloid eruption in "dothienenteritis," although Stewart who was present at the Glasgow hospital when Peebles demonstrated the rubeoloid eruption to Perry, insisted that Perry had maintained (even though Perry in his writings had not stated that "dothienenteritis" had an eruption of its own) the complete difference between the two eruptions. It was Lombard,[15] of Geneva, in 1836, who was the first to state definitely that there were in Great Britain two distinct and separate fevers, one of them identical with contagious typhus, the other a sporadic disease, identical with typhoid fever, or dothienenteritis, of the French. In Germany, however, as early as 1810, Hildenbrand[16] distinguished between the contagious typhus and the non-contagious *Nervenfieber*.

[4] Recherches sur la maladie connue sous les noms de gastro-entérite, Fièvre putride, adynamique, etc., Paris, 1829.

[5] Leçons de Clinique Méd., tom. i, Fièvre typhoide, Paris, 1834.

[6] History of a Fever in the Suburbs of Paisley in 1811, Edin. Med. and Surg. Jour., 1812, viii, 134.

[7] Account of an Outbreak of Fever at Newcastle, Edin. Med. and Surg. Jour., 1818, vol. xiv.

[8] Cases showing the Frequency of Follicular Ulceration in the Mucous Membrane of the Intestines in Idiopathic Fevers, London Med. and Phys. Jour., 1826.

[9] Reports of Medical Cases, London, 1827, vol. i.

[10] Observations on the Epidemic Fever, Now Prevalent Among the Lower Orders in Edinburgh, Edin. Med. and Surg. Jour., 1827, vol. xxviii.

[11] Report of Cases Treated in Edinburgh Infirmary in 1832-33, Edin. Med. and Surg. Jour., 1834, xli; also Elements of the Practice of Physic, vol. i, Fevers, Edinburgh, 1837.

[12] On Epidemic Gastric Fever, Cyclop. Pract. Med., 1833, ii, 233.

[13] Observations on Petechial Fevers and Petechial Eruptions, Edin. Med. and Surg. Jour., 1835 vol., xliv.

[14] Observations on Continued Fever in the Glasgow Hospitals, Edin. Med. and Surg. Jour., 1836 vol. xlv; also, Letter on Typhus Fever, Dublin Jour. Med. Sci., 1836, vol. x.

[15] Études clin. sur les fièvres typhoïdes, Gaz. Méd., 1839.

[16] Ueber den ansteckenden Typhus, Wien, 1810.

To this country belongs the honor of definitely and firmly establishing the two diseases as distinct entities, owing to the epoch-making work and contributions of Gerhard and of Pennock,[17] of Philadelphia. They had studied in Paris under the great Louis, had been shown typhoid there, and on their return had investigated the disease in Philadelphia, but more especially an epidemic of typhus in Philadelphia in the spring and summer of 1836. They recognized the distinction between the disease of this epidemic and the typhoid fever in Paris demonstrated to them by the master clinician Louis. These observations were published by Gerhard in 1837, in February and August, and constitute the final differentiation between the two diseases. There is no chapter in the history of medicine more interesting and fascinating than the evolution of the clinical entities of typhus and typhoid fevers.

I have utilized this brief description of the course of the differentiation between these affections because it indicates how many workers in a field are necessary to establish the entity of any disease, the difficulty encountered, and finally the doubt which arises in many minds before final adjudication removes it. Bearing this in mind, I hesitate to submit the following theme which is based on an experience of 221 cases of an acute infectious disease which has probably for a long time, been considered by others as typhoid fever, but which I hope to show by definite clinical symptoms can have no relation to typhoid fever *per se*, but that it has a distinct clinical entity, entirely separate from typhoid, from typhus, or from any other disease known to me. My object in presenting this study is to enlist the attention of others who may have recognized the essential attributes of this disease, in the hope that by discussion the truth of my observations may be substantiated, or what would be equally advantageous to all, the error of my deductions be indicated.

There can be no doubt that the remarkable discovery of agglutinins by the work of Pfeiffer,[18] Durham,[19] Grünbaum, and that of Widal[20] in establishing the practical basis upon which serum reactions can be made in typhoid fever, has made the diagnosis of typhoid fever, by their demonstration in the blood, much more easy than before the discovery. Equally important with this reaction in simplifying the diagnosis was the establishment of the fact that typhoid fever is a bacteremia and is characterized by the presence of the Eberth bacillus in the blood, more or less constant, at all times of the disease. The practical application of cultural methods to recover the organism from the blood in this dis-

[17] On the Typhus Fever which Occurred at Philadelphia in 1836, Showing the Distinctions Between it and Dothienenteritis, AMER. JOUR. MED. SCI., February and August, 1837, vols. xix and xx.

[18] Zeitschr. f. Hygiene, Band. xxi,

[19] Prac. of the Royal Soc., vol. lix,

[20] Bull. méd., 1896.

ease, demonstrating its presence in over 90 per cent. of all early cases of typhoid fever, has been also of inestimable service in establishing the identity of typhoid and separating it from other bacteremias. Hence it is fair to assume that the recovery of the typhoid organism from the blood has much facilitated the diagnosis of the disease.

Everyone who has had considerable experience with typhoid fever and who has studied the voluminous literature of this disease has learned that the disease is so protean and complex in its clinical picture that at times a diagnosis can only be established with difficulty. Fortunately, deviations from the usual clinical picture are not common. There is a general congener of symptoms, however, whose existence establishes the presence of the disease clinically. While no one symptom may be said to be characteristic of the disease, there are two signs whose presence establishes the disease peradventure. Fortunately these two signs are the most constant, in fact, the only constant factors of the disease: (1) The presence of agglutinins which occur in over 95 per cent. of all typhoid fever cases; (2) the typhoid bacteremia, or the presence of the Eberth bacillus in the blood of patients suffering with this disease, which is constant in over 90 per cent. of cases.

It would seem to me that a clinician would be stepping on very thin ice were he to make a diagnosis of typhoid fever in the absence of the roseola, of the enlarged spleen, of the Widal reaction, of the typhoid bacilli from the blood, from the stools. and the urine, of the symptoms of intestinal ulceration, especially if the fever of the infection ran but a ten to fourteen day course. He certainly would find it well nigh impossible to prove his position. If this proposition be true, its corollary may also be assumed to be true, viz., that given a disease of definite duration, twelve to fourteen days, having a most extensive non-roseolar eruption, giving no clinical signs of intestinal ulceration, with the Widal reaction invariably absent at all times of the disease, with no organisms in the blood at any time during its course, and with a fever that falls by crisis, such a disease is most likely not typhoid fever.

It may be noticed in this argument that I have made no reference to a pathological basis of the disease I am about to describe, or to that of morbid anatomy. I wish I could, because knowledge from those sources might establish the truth, as occurred with typhus and typhoid fevers in England and France just one century ago. But in my study of the disease which forms the subject of this communication, I have not met with a single fatal case and therefore can offer no contribution to its pathology and morbid anatomy.

History. The theme, as may be inferred from these preliminary remarks, is based on a careful clinical study of 221 patients suffering from an acute infectious disease, and was begun late in 1896 and carried on since then. At that time, with a fairly large typhoid

fever service at Mount Sinai Hospital, I noticed a type of disease occurring mainly in the summer and fall months, somewhat similar, but characterized by many features irreconcilable to the picture of typhoid fever, such as the course (being twelve to fourteen days), the temperature descent, which was mostly by crisis, the eruption, which was maculopapular and did not disappear on pressure, and the absence of the Widal reaction in this group.

Widal had just published the agglutination test which is now known by his name, and we began our investigations with it. What struck me forcibly was the positive results we got with the typhoid fever cases and the invariably negative results with this group which we had separated clinically from these cases. Our investigation was further carried on during 1897. We attempted to recover, if possible, either a typhoid bacillus or some other pathogenic organism from the feces, the urine, and, even at that date, from the blood of the spleen obtained by aspiration puncture, but with negative results. The results of this clinical work were published by me in an article entitled "A Study of Seventeen Cases of a Disease Clinically Resembling Typhoid Fever, but without the Widal Reaction, together with a short Review of the Present Status of the Serodiagnosis of Typhoid Fever."[21]

With the limited material of this type of disease at my disposal at that time, my judgment as to the eruption was not as matured as it is now. I spoke of the eruption being roseola and disappearing on pressure. This was a mistake which I have long corrected, and was occasioned by the fact that there may be found here and there among the spots of the characteristic type of eruption, a few which may disappear on pressure. Since that time I have constantly and persistently watched for similar cases, and have collected up to December 1, 1909, from my service and my colleague's at Mount Sinai Hospital, 221 patients with the following type of disease. The most of these I have seen personally.

DEFINITION. An acute infectious disease of unknown origin and unknown pathology, characterized by a short incubation period (four to five days), a period of continuous fever, accompanied by intense headache, apathy, and prostration, a profuse and extensive erythematous maculopapular eruption, all of about two weeks' duration, whereupon the fever abruptly ceases either by crisis within a few hours or by rapid lysis within three days, when all symptoms disappear.

GENERAL DESCRIPTION. After a period of three or four days, during which the patient suffers from malaise, loss of appetite, nausea, and slight headache, the disease begins rather abruptly, many times with a chill or chilly sensation. This is followed occasionally by vomiting, by general body pains or pain in the

[21] N. E. Brill, New York Medical Journal, January 8, 1898, and January 15, 1898.

back; epistaxis sometimes occurs. The headache now becomes intense and apathy and prostration supervene with the rapidly rising temperature. The fever reaches its height in two to three days, when it remains constant thereafter, the temperature showing but slight diurnal remissions. During the fastigium of the fever the patient lies very quietly, sometimes moaning or groaning, with facial expressions of pain shown by the contracted and furrowed brow. His eyes are dull and suffused, his conjunctivæ congested, and his face, especially over the malar prominences, flushed. He is rather drowsy, his sensorium dulled, and he resents being disturbed by more marked expressions of pain; any attempt to move him increases his headache. The tongue is usually coated and moist, only occasionally is it dry and furred. The skin of the body feels hot and dry. The headache remains intense without diminishing in severity, and about the sixth day a rash appears. The eruption is found over the abdomen and back, and quickly spreads to the thorax and to the arms and thighs and occasionally to the neck, forearms, hands, legs, and feet. I have seen the whole body, even including the palms and soles, excepting the face, covered by the eruption. The rash is dull red in color, very slightly raised, and when subjected to pressure does not disappear. The individual spots on pressure fade slightly in color, and only very rarely can they be obliterated, but return to their florid efflorescence as soon as pressure is removed. The bowels are obstinately constipated, as a rule, and in many cases can only be moved by laxative agents. The pulse is full, rather slow, not nearly as rapid as might be expected with the pyrexia. It is soft and of low tension and often dicrotic. These symptoms remain in full development until about the twelfth day, when the fever abruptly disappears, the patient's temperature suddenly dropping in a few hours to normal, the rash fades, the headache leaves, the apathy and prostration vanish, and the patient feels perfectly well, taking an interest in his surroundings. A rapid convalescence follows. During the progress of the disease slight emaciation may develop, but rarely very marked. The urine is scanty, high colored, and at times contains albumin. Delirium is only exceptionally noticed, and then only at night in the patients with hyperpyrexia. A few patients show rigidity of the neck, and the presence in them of the Kernig sign may be elicited.

Etiology and Analysis of Symptoms. I have selected the histories of the last 50 cases of my series, chiefly because these histories were readily accessible and because I have had the symptoms tabulated for the purpose of comparative study. These 50 cases have come under my observation since June, 1906, and extend to December 1, 1909.

Sex. Males show a greater tendency to be affected than females. There were 34 males and 16 females.

Nativity. Inasmuch as the largest number of patients at Mount Sinai Hospital are Russians, Russia leads the list of cases with 30; Austria, 12; United States, 2; Ireland, 2; Germany, 1; not noted, 1.

Month. By far the largest number of cases occur in the summer months. Of this group there were 1 in January, 3 in February, 3 in March, none in April, 3 in May, 8 in June, 8 in July, 2 in August, 6 in September, 11 in October, 3 in November, and 2 in December.

Age. The disease is most common between the twentieth and fortieth years of life. In this group 33 appeared in that period: First to second decade, 9 cases; second to third decade, 19 cases; third to fourth decade, 14 cases; fourth to fifth decade, 4 cases; fifth to sixth decade, 2 cases; sixth to seventh decade, 2 cases. The youngest patient of this group was aged seventeen years, the oldest was sixty-five years.

Contagion. I can find no evidence of the disease being directly communicable. In the 221 cases we have not had, so far as I can learn, two members[22] of the same family, nor two from the same household or same house. The patients are admitted into the general wards, and the disease has never been communicated to any other occupant of that ward; nor has the disease ever arisen among the patients in the hospital. One of the nurses of the Training School who, in December, 1896, went through a severe typhoid fever infection, was attacked six months later with this disease, though at that time there was no other case of this disease in the hospital or training school. She was the only person I have seen developing the disease within the hospital.

Food Poisoning. It might be asked whether the disease has any relation to the ingestion of certain foods or to the toxins contained in decomposing food. The *prima facie* evidence seems to be against this view, for, if such were the cause, the disease would necessarily be widespread in special districts and affect many in a single family; secondly, the infection is not confined to any race, even though some races eat certain articles of food proscribed by others. We have found the infection in Germans, Americans, Austrians, and in the Celtic race. There is no analogy between this affection and the group of meat-poisoning cases known as botulism, and which seem to be due to the special organism of the Gärtner group—Bacillus enteritidis group. This group has the quality of interagglutinating, and its bacilli are often agglutinated by typhoid serum. In our examinations no such agglutination could be obtained. It seems highly improbable that a constantly definite and distinct type of disease, with unvarying type of eruption, running a definite course, subsiding at a definite period, and show-

[22] Since this was written I have had the opportunity to see at Bellevue Hospital, through the courtesy of Dr. Warren Coleman, four members of one family who were attacked almost simultaneously with this disease.

ing the character of this disease, could be due to a chemical ptomaine rather than to an infectious organized agent.

Incubation. The period, before the acute symptoms begin, varies in duration from sudden onset without premonitory symptoms to fourteen days. In 15 of this group of 50 cases the incubation period could not be ascertained, in 35 it varied from a few hours to fourteen days. The average of this stage of the disease was four and eight-tenths days. During it the patient suffered with malaise, fatigue, anorexia, constipation, dull feeling in the head or a distinct headache. Sometimes he complains of nausea and indigestion and painful sensations over the body. After this stage the disease in its intensity may be said to begin.

Onset. This may be sudden, when it is marked by a distinct chill, or chilly sensation, with increased general body pains or pains in the back, by nausea, and sometimes by vomiting. Now the headache becomes intense. Or the onset may be gradual, when it cannot be separated from the incubation period. In the latter case only the development of the fever and the increasing headache permit one to define this stage of the disease. In 19 cases the onset was sudden; in 31 the disease began gradually.

Epistaxis, while it occasionally occurs, is not common. It was noted during the course of the disease in three cases.

Headache. This is one of the most pronounced features of the disease and is almost invariably present. It may start in with the incubation or it may not appear until the onset. It becomes intense and at times agonizing, and in severity is only equalled by the headache of a meningitis, of a cerebral tumor, or the head pains occasionally present with syphilis. It lasts, as a rule, in all of its intensity throughout the disease, and then only disappears with the crisis. In the latter respect it differs from the headache of typhoid fever, which, as is well known, diminishes in intensity in the second week of that disease and is then no longer the chief subject of the patient's complaints. In this disease the headache is much more severe, and it lasts throughout its course until convalescence begins. The headache is general and is not confined to any locality of the head, being as severe in the occiput as in the frontal and temporal regions. In the cases in which the headache is most intense rigidity of the neck is sometimes observed; when the latter is present, a distinct bilateral Kernig sign may be observed. Rigidity of the neck and Kernig's sign were noted in four patients of this group. Lumbar puncture was made in these four patients, and the cerebrospinal fluid was examined culturally and cytologically. The growth was sterile in all, and the proportion of lymphocytes was slightly increased. The headache was agonizing in 8, intense in 33, and moderate in 9. With rigidity of the neck, there may be contracted pupils and, rarely, muscular twitchings and active reflexes.

Facies. The patients suffering with this disease look sick, much more so than a patient in the corresponding period of typhoid fever. The face is flushed, especially deeply over the malar prominences, the flush being, sometimes, not noted about the nose and mouth, which then may look unusually pale. The conjunctivæ are congested, the eyes suffused and later may become dull in expression. The forehead is wrinkled and the brows drawn together giving the expression of headache with which they suffer. The attitude in bed is generally relaxed, the patient being inordinately quiet. He does not toss about, as motion increases the headache. He resents being disturbed, and responds with reluctance to questions. He utters moans and groans and points to his head when asked where he suffers. It would seem to me that the physical relaxation and the indifference shown to the examiner represent an apathy which is only disturbed by an attempt to move him. This apathy is marked in most of the cases. In 6 of our group it was extreme, it was marked in 17, and absent in 12. In 15 the condition was not recorded.

Prostration. There can be no doubt, after one has seen a few of these patients, that this symptom is a striking one. It is marked by the general muscular relaxation, the posture of the patient in the bed, the indifference of the patient to his surroundings, and his lessened ability to move. It usually corresponds in intensity with the intensity of the infection, and is more marked with patients showing a hyperpyrexia than in the milder cases of the disease.

Skin. During the course of the disease the skin is hot and dry. Between the fifth and seventh day of the disease a maculopapular eruption appears, first on the back and abdomen and then over the trunk. The rash may spread rapidly, and in a great number of cases the arms and thighs may be covered. In a few cases the eruption involves, in addition, the neck, forearms, hands, legs, and feet, even exceptionally the palms and soles. At times the eruption is more profuse on the extremities than on the trunk. The eruption does not appear in crops, as in typhoid, but the spots appear synchronously over the area of the body which they invade. Each spot lasts throughout the rest of the course of the disease. It is noticeable that the rash is the most profuse when the attack is most severe. The spots are distinctly maculopapular, are only slightly raised and may be designated as an erythema. They are dull red in color. They vary in size from two to four millimteres, are uneven in contour, and are irregularly round or oval, their periphery being commonly diffuse and indistinct. If subjected to pressure they do not disappear, but fade slightly. This is best tested by pressing them with and under a glass microscopic slide, when all gradations of pressure effects may be observed. The eruption is more nearly morbiliform or rubeoloid than roseolar. In three of this group the eruption in places was distinctly petechial, suggesting a typhus fever eruption more than any other eruption.

From this description it may be seen that the eruption in no respect resembles that of typhoid fever, the eruption of which is characteristically papular, circumscribed and lenticular, appears in crops, very rarely involves the extremities, is never more profuse on the extremities than on the trunk, has never to my knowledge been observed to attack the palms and soles, and almost always disappears completely on pressure excepting in "hemorrhagic typhoid fever." The eruption of typhoid fever consists of hyperemic spots; in this disease it is distinctly erythematous, some of the capillary contents escaping into the surrounding tissues, leaving a more or less permanent zone which pressure cannot remove. I have looked for the subcuticular mottling of typhus, but have never observed it in these cases.

The eruption does not begin to fade until the crisis, then it rapidly becomes paler, and in two days thereafter only dirty yellowish-brown stains mark the site of the former spots. When petechiæ are present, the punctate hemorrhages disappear much more slowly. The rash is not nearly as discrete as it is in typhoid, for two or more spots frequently coalesce, a condition which is commonly seen. I have never observed the eruption on the face, but have seen it occasionally extend up the sides of the neck, involving the skin over the mastoids and even the back of the ear. Contrary to the typhoid eruption, which, as a rule, is not abundant, but occurs in varying crops of ten to twenty in number, this is, as a rule, an abundant eruption. In our series the following was the distribution of the eruption: Abdomen, chest, and back, 13 cases; abdomen, chest, back, arms, and thighs, 22 cases; abdomen, chest, back, arms, thighs, forearms, and legs, 9 cases. Distribution not noted, 6 cases. Of those with profuse rash involving the forearms and legs—9 in number—the eruption was observed on the palms and soles in 4, and on the neck in 3 cases.

Herpes. Labial herpes was noted as an accompaniment in 3 out of the 50 cases.

Pulse. The pulse rate, considering the fever, is not very high; it averages between 86 and 100 beats per minute. It is full, soft, and of low tension. Dicrotism is not infrequently observed.

Temperature. The course of the fever is rather distinctive. The patients' temperature begins to rise at the onset, usually three or four days after the stage of incubation, and then with rapid strides, so that on the second or third day from the onset it may have reached its fastigium. It then averages between 103.6° and 104.2.° It is but slightly higher in the evenings, and continues high throughout the rest of the disease. The remissions between morning and evening seldom exceed 1° F. With the exception of these remissions the temperature remains constantly and uniformly high until the day before the critical fall, when a precritical rise may occur. In four of these 50 cases a precritical rise between

105° and 106° F. was observed. The precritical rise, however, is not the rule and only occasionally occurs. On the twelfth to the fourteenth day the temperature begins to drop. The fall is quick and abrupt, and in some of our cases within ten hours from 105° F. to normal. The critical fall occurs in a large number of the cases. In also a fair proportion of the group the temperature falls by rapid lysis (Figs. 1, 2, and 3). In this connection we have assumed as a standard by which judgment may be expressed the following: A crisis to be a fall in temperature to normal within twenty-four hours; rapid lysis to be a fall to normal in forty-eight hours; and lysis to be a fall to the normal within seventy-two hours. As a rule, after the fall, whether by crisis, rapid lysis, or lysis, the temperature does not rise again. Exceptionally a short rise, lasting but a few hours or a day thereafter, was observed. The most remarkable feature of this disease is that with the fall in fever all the signs clear up, and the patient, who may have felt and looked very sick, becomes alert, interested in his surroundings, and says he is well; the headache is dispelled, as if by magic; the eruption rapidly fades, and convalescence is established. In this group there was a critical fall in 16 cases, a fall by rapid lysis (less than forty-eight hours) in 17 cases, a fall by lysis in 17 cases. I have not seen a single patient whose temperature took more than sixty hours to fall to the normal, excepting with a complication.

Eyes. In 28 cases the eyes were suffused and the conjunctivæ congested; in 18 they were not affected; the condition was not noted in 4.

Tongue. The tongue is at first moist and coated with a white fur, the tip and sides remaining red. This condition may last throughout the disease, although in some of the cases with hyperpyrexia the tongue becomes dry and brown.

Constipation is a marked feature of the disease. It was present in 42; in 6 the bowels were regular, and in 2 there was a diarrhœa following a previous constipation. Very frequently the bowels can only be moved by the use of cathartics. Blood has never been found in the fecal discharges, either macroscopic or microscopic. The guaiac and benzidin tests for occult bleeding have been negative.

Tympanites is not a feature of this affection. In 9 cases a slight abdominal distention was observed.

Spleen. This organ is frequently enlarged to palpation. In 27 cases of the series it was distinctly palpable below the costal margin. At times the spleen extends for a considerable distance below the ribs, four centimeters below being the maximum. In 16 cases it was one centimeter below; in 7 cases, two centimeters; in 2 cases, three centimeters; and in 2 cases, four centimeters.

Mental Symptoms. The apathy and dulled sensorium have been mentioned in the general description. Delirium is only

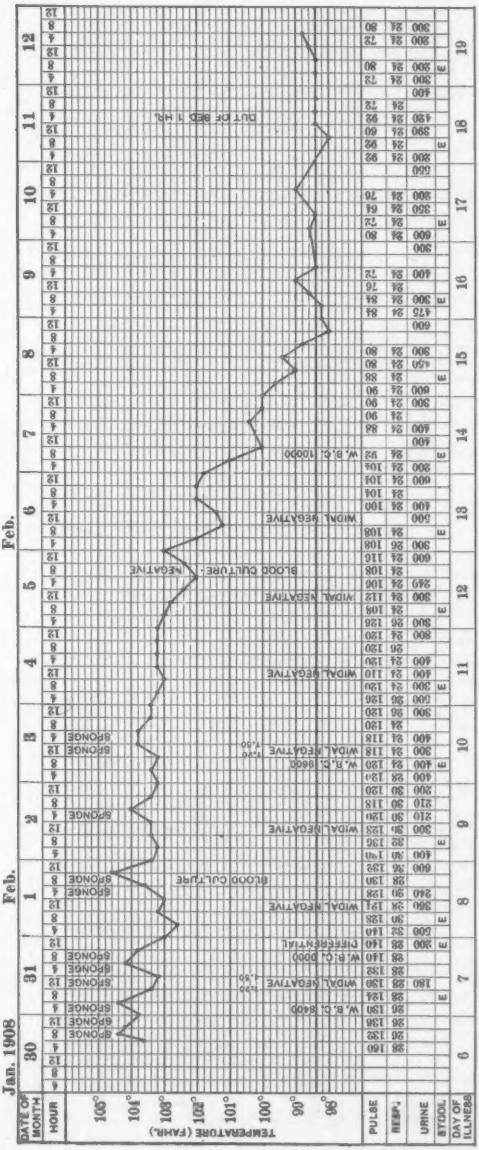


FIG. 1.—The temperature record, showing a fall by lysis within sixty hours, beginning on the thirteenth day.

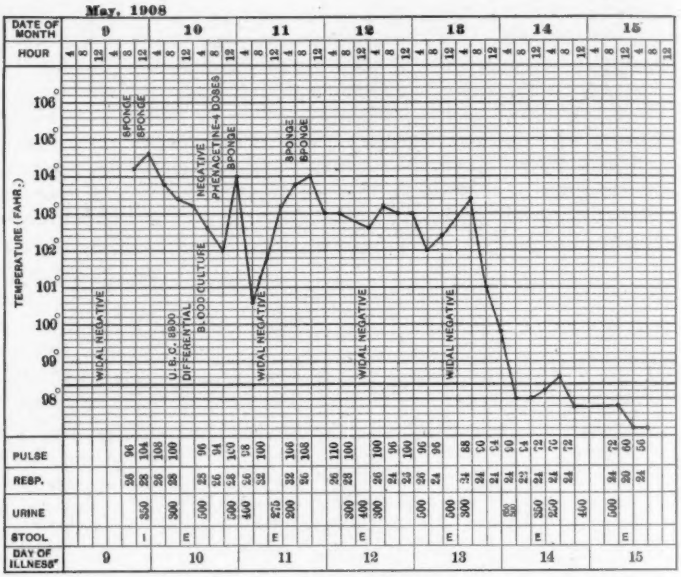


FIG. 2.—The temperature record, showing a critical decline (slight precritical rise) to normal within twelve hours, occurring on the thirteenth day.

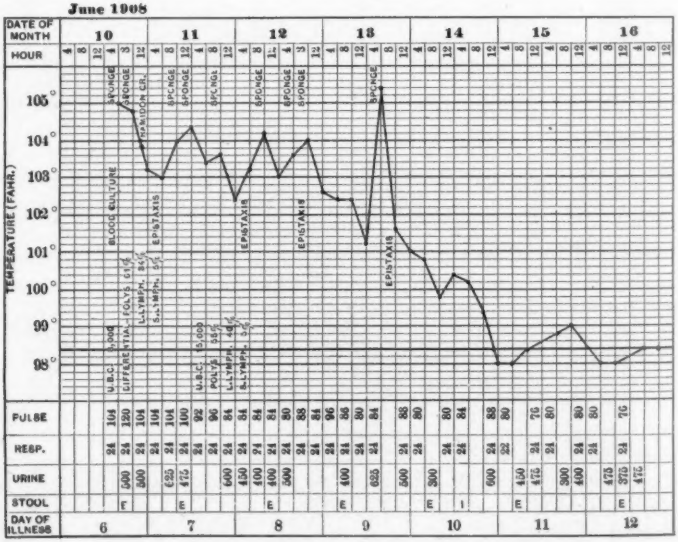


FIG. 3.—The temperature record, showing the precritical rise to 105° and decline by rapid lysis within thirty hours, on the ninth day.

occasionally present, and it does not assume the active type so commonly seen in typhoid fever. It usually occurs in those running a high febrile course, and then only at night. It is muttering in character.

Blood. The average white blood cell count is higher than it is in typhoid fever; there is not the tendency to leukopenia which typhoid fever blood shows, the count being between 9000 and 11,000. When bronchopneumonia exists as a complication the count is, of course, higher; our highest in such a case was 23,600. The average of the series—in only one case was no white blood count noted—was 9394, the lowest being 4200 and the highest 23,600, the last being in the patient with bronchopneumonia. The average count of polymorphonuclears was 69.4, and the lymphocytes, 30.6 per cent.

Urine. The urine is generally high colored and clear. It contains a faint trace of albumin in many cases and occasionally granular casts. Albumin was noted in 19 of the cases. The diazo reaction is not infrequently obtained, but it is more frequently absent than present. It was demonstrable in 9 cases, and no reaction could be elicited in 30; in 11 cases it was not noted.

Agglutination Reactions. In the 221 cases there has not been a single positive reaction to the Widal test. The test has been carried on perhaps much more assiduously than would have been the case had positive results been obtained. The blood has been sent to the laboratory daily in most all of the cases, not only during the course of the disease, but during the period of convalescence until the patient left the hospital. No positive reactions have been obtained. Tests were made in dilutions of from 1 to 20, and in some cases up to 1 to 1000, because it has been shown that agglutinations with the typhoid bacillus in some cases of typhoid fever are demonstrated only in high dilutions. Agglutination tests were also made in some of the cases with various paratyphoid bacilli, with several colon strains, and in a few cases with the Gärtner bacillus. The results were all negative. I believe that the absence of positive results speaks very strongly against these cases being due to infection by the typhoid bacillus or members of the intermediate group.

Bacteriology. The evidence of infection by the recovery of the offending organism in this disease is entirely wanting. Since 1896 we have persistently tried to isolate a specific organism from these cases, but without success. Blood cultures have been made in a very large number of the cases. During the past three years cultures have been made from all of the cases that have come under observation. The cultures in these cases were made under the direction of Dr. Libman. The methods used in this work during the past three years are the same as those that were used in the

studies of the bacteremia in typhoid fever made by Dr. Epstein.[23] Dr. Epstein obtained positive results in nearly all of the cases of typhoid fever. This makes all the stronger the proof that in the set of cases which I am describing we are not dealing with typhoid fever or paratyphoid fever.

The clinical aspect of the disease is strongly in favor of its infectious nature because it has a definite incubatory stage, one of onset, one of duration, and one of decline. We regard typhus fever, measles, scarlet fever, and the like as infections, and have no definite knowledge as to the nature of the infection, hence the absence of such knowledge as to this disease should not militate against considering it an infectious disease.

PREVIOUS TYPHOID. We carried on an inquiry based on immunity which typhoid fever gives to the one who suffered previously from typhoid, and found that in the group of 50 there were 10 who had had typhoid fever previously, 37 who had not suffered from typhoid fever, and 3 could give no information concerning previous illnesses.

If typhoid fever produces a short immunity, as has been shown, we would have a strong argument in favor of the cases here described not being typhoid, in the case of the nurse in the Training School, who had a severe typhoid infection in December, 1896, and who suffered with this infection in September, 1897.

RELAPSES. I have never seen a relapse in this disease. When the temperature once falls the disease ends. Unless there be a complication the fever does not rise again. This is so entirely different from the course of typhoid infections that in itself it would cast a serious doubt on the probability of this disease belonging to the typhoid fever group, with which some of my professional colleagues insist it belongs. They have stated in medical meetings that they see no reason why these cases should not be classified as atypical or abortive typhoid fever. I shall discuss this later in the section on diagnosis; for the present, however, I wish to call attention to the subject of relapses in abortive typhoid fever as presented by Dr. J. B. Briggs from Professor William Osler's clinic at Johns Hopkins Hospital. Dr. Osler[24] says: "J. B. Briggs has studied 44 of these mild cases from my clinic, in which the fever lasted fourteen days or less. Rose spots were present in 24, and the Widal reaction in 26. There were three relapses."

According to Murchison[25] and Curschmann,[26] relapses are especially prone to occur in the abortive type of typhoid fever.

[23] AMER. JOUR. MED. SCI., August, 1908, p. 190.

[24] The Principles and Practice of Medicine, by Wm. Osler, M.D., sixth edition, 1906, p. 91.

[25] A Treatise on the Continued Fevers of Great Britain, second edition, London, 1873.

[26] Der Unterleibstyphus, Spec. Path. und Ther. (Nothnagel), Wien, 1902; also, American edition, with additions by Wm. Osler, Philadelphia, 1902.

With such a weight of authority as to the occurrence of relapses in abortive typhoid and the entire absence of relapses in this affection, one should at least be guarded in making positive statements as to the identity of this disease with typhoid infection.

COMPLICATIONS. *Bronchitis* is a common accompaniment of the disease and is present to a greater or less degree in the majority of the patients. When it develops, it is seen early, sixth or seventh day. It lasts as a rule, throughout and disappears in convalescence.

Bronchopneumonia was observed in 3 of the group.

Meningismus. What clinicians call signs of "serous meningitis," such as rigidity of the neck, contracted pupils, the presence of bilateral Kernig phenomenon, stupor, etc., are sometimes present. These signs were noted in four of the 50 of this group.

Phlebitis cruris was observed once.

Otitis media occurred in one patient.

Cystitis was observed twice, but I think it was due to some error in the technique of catheterization, which was done on both these patients.

DURATION. The disease lasts about two weeks. In our series the average duration was thirteen and three-tenth days. In one case it lasted five days and in one, twenty-two days. The last case, however, was accompanied by a bronchopneumonia and it was difficult to determine when the original infection terminated. The detail of the series is as follows:

5 days	1 case	14 days	5 cases
6 days		15 days	5 cases
7 days	1 case	16 days	2 cases
8 days	1 case	17 days	3 cases
9 days	1 case	18 days	
10 days	2 cases	19 days	1 case
11 days	4 cases	20 days	
12 days	13 cases	21 days	
13 days	10 cases	22 days	1 case

It will be seen from this that almost half the cases terminated between the twelfth and thirteenth days. This has been our experience with the rest of the 221 cases. A prediction may almost be made that the disease will terminate on one of the two days just stated.

DIAGNOSIS. To one who has had the features of the disease pointed out to him, the diagnosis is relatively easy. For the past few years the members of my house staff recognize the disease and make the diagnosis before my visit to the wards. This is also the case with the members of the "Admitting Department Staff" in the hospital. It is only on rare occasions that their judgment is found to be incorrect. It seems to me, if it be possible on first examination to predict, as it has been almost invariably, in these cases, that a patient having an eruption of this type will

not show at any time a positive Widal or give a positive blood culture, we are dealing with a disease *sui generis*. The positive factors of this disease which would suggest its presence when first seen by the examiner, are the facies, the headache, especially and definitely the eruption, the apathy, prostration, and the palpable spleen. It requires no great clinical acumen to differentiate the eruption, after its characters have been pointed out a few times. I have shown the eruption and along side of it in a typhoid fever patient, a roseola eruption, and the differences were so striking that the members of the house staff quickly learned to detect the differences.

DIFFERENTIAL DIAGNOSIS. Inasmuch as these cases have been considered by almost all my colleagues in New York, in the past, as typhoid fever cases, it will be necessary to show the marks of differentiation. The parallel column offers itself for this purpose as most convincing:

Typhoid.	*Unknown Infection.*
Usually long incubation.	Short incubation, four to five days.
Onset not commonly abrupt.	Commonly with chill or chilly sensation.
Fever; gradually increasing ascent of temperature to fastigium—in all about ten days.	Fastigium reached in three days.
Remissions of temperature occasionally more than a degree.	Rarely more than one degree.
Fall usually by gradations to normal, taking commonly one week.	Fall commonly by *crisis*, not longer than sixty hours.
Eruption, circumscribed, lenticular, papular.	Maculopapular, periphery indistinct and irregular.
Distribution, chiefly, back, and abdomen, seldom appearing on upper and lower extremities; almost unknown on palms and soles.	Distribution in addition to trunk on upper and lower extremities not infrequent, on palms and soles occasionally.
Eruption appears in crops throughout the disease.	Does not appear in crops.
Spots rarely confluent, and then confluence of but two spots.	Confluence may occur with three or four spots forming a number of patches.
Roseola disappearing on pressure.	Erythema, not disappearing on pressure.
Petechial spots (hemorrhagic) very rare.	Petechiæ occasionally.
Apathy and prostration late in development.	Apathy and prostration early.
Labial herpes rare.	Labial herpes in 6 per cent. of the group.
Diarrhœa fairly common.	Constipation an almost invariable accompaniment.
Hemorrhages from the bowel often observed.	No intestinal hemorrhages or blood in feces.
Headache disappears in second week.	Is more intense and lasts throughout the disease.
Relapses observed by all observers.	Relapses have never occurred.
Widal reaction positive in over 95 per cent. of the cases.	Widal reaction invariably absent.
Blood cultures positive in over 90 per cent. of the cases.	Blood cultures invariably negative.
Convalescence slow.	Convalescence speedy.

Typhus Fever. In the case of an epidemic of typhus fever, in my opinion, it would be simply impossible to say that these cases which I have described were not mild typhus fever. From the

clinical aspects no lines of demarcation can be fixed. The onset, the eruption, though subcuticular mottling is absent, the critical decline, the absence of relapses are almost identical in both. If one can believe that typhus fever has been so modified by modern conditions of hygience as no longer to be communicable, but to exist at all times in a community, to have lost its notoriously epidemic character, and to have been deprived of the grave nervous symptoms and its toxemia so as to be a non-fatal disease, then one could say that these cases deal with a modern typhus fever, or rather with a peculiar typhus fever which has been evolved by modern improved hygiene and sanitation. The preference of the disease for developing in the summer months is against the probability of its being typhus. Clinically this disease resembles typhus fever more than it does any other disease, and I should have felt that I had offered nothing to our nosology if it had been proved that typhus fever had lost its virulence, that it was constantly present in a community, that it was not communicable, that when it was present epidemics of it did not occur, and that it was no longer a grave and fatal disease. But with typhus fever, as the great masters of medicine have taught, and as I have seen it, such a conception would be unjustifiable; therefore, I believe this disease not to be typhus fever.

Meningitis. The occasional occurrence of signs of "meningismus" in this disease might suggest epidemic cerebrospinal fever ("spotted fever"). There would be no very great difficulty in determining the presence of that disease if spinal puncture were carried out and the cerebrospinal fluid examined culturally. Its cytology and bacteriology are definite, and the recovery of Meningococcus intracellularis would settle the diagnosis.

Influenza. In epidemics of this disease some cases might appear which have a great similarity to our disease. Those of us who dealt with the type of influenza as it appeared here in 1890 will no doubt recall cases very similar. The protean forms that were then observed would very likely suggest that perhaps this disease might be one of the multivaried or protean forms of influenza. Influenza appears pandemically, is very sudden in its onset, and prostration is the earliest symptom; it has no definite incubatory stage; it is accompanied by signs of cardiac weakness with rapid pulse and often with diarrhœa. It is par excellence the disease of complications and sequels, and especially of slow convalescence.

PROGNOSIS. Thus far it has been invariably good. No fatalities have ever occurred in my cases. Sick as the patients are and grave as the symptoms sometimes appear to be, one ought from this experience be justified in predicting a favorable issue to the disease.

TREATMENT. This for the present should be entirely symptomatic. Personally I have used no stereotyped plan. The usual remedies have been employed for the symptoms which required

relief. The diet has been restricted to fluid and soft nourishment. For the present I deem it wise, especially in cases occurring in institutions to use the usual precautionary measures which are employed in typhoid fever cases to prevent infection; nurses are so instructed in handling these patients. Such precautions, however, would seem to be unnecessary; nevertheless in the indefinite state of knowledge concerning the causative factors of this disease no injury can be done in using preventive measures.

EPICRITICAL. More difficult than separating this group from typhoid fever, among which it has been in all these years included, is the difficulty of giving a name to this disease. To my mind there can be no doubt that the clinical picture is so definite, so marked that it cannot escape recognition. If this should be the view of others, the disease must represent a distinct clinical entity. I am convinced it does and is entitled to a place in medical nosology. There is no sign in the clinical picture which would characterize the disease. The critical fall is definite and I thought it might be wise to use that feature for a provisional name, calling the disease "critical fever;" but pneumonia and typhus fever are likewise critical fevers. On this account the name is not desirable. I should emphatically deprecate calling the disease "pseudo-typhoid fever" because the affection has nothing in common with typhoid, paratyphoid, and typhoid-colon, or intermediate group infections. Some years ago, before we had done reliable blood work on this group, I believed that it might represent paratyphoid infections, and so I wrote,[27] but retracted that idea long ago, after I had convinced myself that the disease had nothing in common with paratyphoid. If it be typhus fever Health Boards should take cognizance of the fact that there exists in New York City at all periods of the year a non-fatal and non-contagious typhus fever which may possibly give rise at any time to an epidemic, though it has not done so in the last fourteen years. For the present, owing to ignorance of the pathology and etiology of the disease, I deem it wise not to give a name to the affection. I prefer to speak of it as an "acute infectious disease of unknown origin." My chief desire, in recalling to the attention of the profession this disease group, is to enlist its attention, in the hope that other observers may find similar or identical cases. Let us trust, if they do, that they can give us more definite and accurate knowledge than I have been able to offer. If this be the result of this contribution, or, if further inquiry shows that my attempt to establish a clinical entity has been based on poor observation and defective deductions, I should have almost as great satisfaction as would corroboration and additional proof bring to me, for it would have further and more forcibly taught me that while it is human to err, still truth will always prevail.

[27] N. E. Brill, Paratyphoid Fever, Medical Record, November 29, 1902.

A CASE OF THE ADAMS-STOKES SYNDROME OF PROLONGED DURATION, ENDING IN APPARENT RECOVERY.

By Henry C. Earnshaw, M.D.,

ASSISTANT PHYSICIAN TO THE BRYN MAWR HOSPITAL, BRYN MAWR, PENNSYLVANIA; ATTENDING PHYSICIAN TO THE HOSPITAL OF THE GOOD SHEPHERD, ROSEMONT, PENNSYLVANIA.

The case which I report herewith, is that of an individual who has suffered from a number of prolonged attacks of complete auriculoventricular heart-block, and who made what for a time appeared to be a perfect recovery; but very recently (since the completion of this paper) he suffered a recurrence of the heart-block that lasted several days and then disappeared. So much has been written of late regarding the Adams-Stokes syndrome and heart-block that it is unnecessary to recapitulate all that has been learned regarding its etiology and pathology. Suffice it to say, that at present it is generally regarded as resulting from a complete or partial failure of the auriculoventricular bundle to conduct to the ventricle the stimulus to contraction which it receives from the auricle. As a result of this, the auricles beat more frequently than the ventricles, and, as might be supposed, marked disturbances in the arterial circulation occur and lead to the syncopal attacks and convulsive seizures which characterize the syndrome.

J. M. W. T., a male, aged fifty years. The patient's father died of angina pectoris; his mother died of carcinoma; one brother and one sister died in infancy. Four brothers and four sisters are living and well. The patient does not use alcohol; he uses tobacco, but not to excess. His bowels are usually regular. A specific history is absolutely negative. When a child he had chickenpox, mumps, and measles twice. He never has been seriously ill. He is subject to colds at times. He once was ill for three days with influenza several years ago. Most of his exercise was confined to walking and bicycle riding. On August 13, 1908, he came to me suffering from a neuritis of the left arm, which disappeared under the use of salicylates.

On November 19, 1908, having previously felt very well except for fatigue, he went to bed at his usual hour for retiring. Later in the night, in getting up to go to the bathroom, he suddenly lost consciousness for about one-half minute, and found he had dropped down on his knees. On arising he did not feel very weak, and went back to bed. Twice more during the night in getting up he fell to the floor, each time going back to the bed. There was no headache or nausea, but the patient vomited later, in the early morning. The bowels were regular, and urine had been passed during the night. I was called in to see him the next morning, November 20.

The patient before the attack was a well-developed man of medium stature, reddish-gray hair, florid complexion, well built, and with well-nourished skin. I now saw him quite pale, all mental faculties good, looking very ill. The pupils reacted normally, his tongue was coated, the arteries were fairly soft. The chest was well developed, the abdomen and extremities normal. Now and then, while answering questions, he would become very pale, the pupils would contract, the eyelids flutter rapidly, the eyeballs roll upward, the facial muscles twitch, and a general body convulsion would follow, the patient losing consciousness rapidly as the attack came on. The pulse would disappear at the wrist, and there was pulsation in the veins of the neck. Suddenly a faint flush would spread over the face, rapidly increasing in intensity. Following this there would be a return to consciousness, the patient looking rather bewildered, but soon he would take up the conversation again where he had stopped. The unconsciousness would last less than half a minute. The pallor would return gradually, but not to so marked a degree as before the attack. Occasionally he would vomit, but said there was no nausea, that the food would simply regurgitate. The pulse was 40 to 50 beats to the minute. After the convulsions the pulse would increase slightly in rapidity. It was quite strong and regular. After the attack the patient said he could feel the blood rushing through all parts of his body.

The heart dulness was apparently normal; the apex beat in the fifth interspace in the midclavicular line; the sounds were strong and regular; the pulmonic second sound slightly accentuated; a very faint systolic murmur was heard at apex, but was not transmitted. The liver, spleen, and lungs showed nothing abnormal.

The urine was acid, amber, cloudy, and deposited a moderate sediment. The specific gravity was 1012. Albumin was present and marked. Sugar was absent. Microscopically, amorphous urates, an occasional granular cast, and epithelium were found.

The attack continued all day with slight improvement. Toward night, the pulse rate was 50 to the minute.

During the day a series of convulsions and flushings would occur in the space of an hour; then no more for several hours. The vomiting also kept up until evening. About midnight he was more comfortable. The next morning the pulse had increased to about 60 beats to the minute. Through the day he had an occasional convulsion followed by flushes. One the third day, except for a very occasional flush, the patient was in a better condition. The pulse rate was now about 70. Convalescence continued uninterruptedly and by November 27 the patient had fully recovered, the pulse rate being 80 to 90, and the urine normal. The patient then went to Baltimore, where he underwent a thorough

physical examination by Dr. W. S. Thayer. All symptoms had cleared up and the heart was in good condition.

He then returned home and went about again as usual, except that he was careful in regard to exercise, until December 27, 1908.

Second Attack. On December 27, 1908, while at the telephone, he was suddenly seized with an attack, and fell to the floor. He had felt very tired for two or three days previous to the attack. I found his condition similar to the first attack. The temperature was subnormal, the pulse about 65 to 70; occasional flushes occurred. A nurse was called in and notes were made daily from that time until apparent recovery.

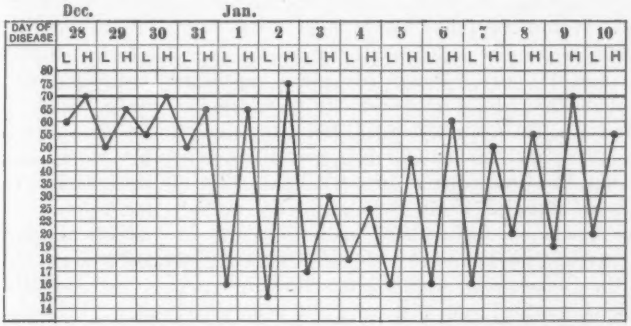


FIG. 1.—The pulse rate during the second attack. H, high; L, low.

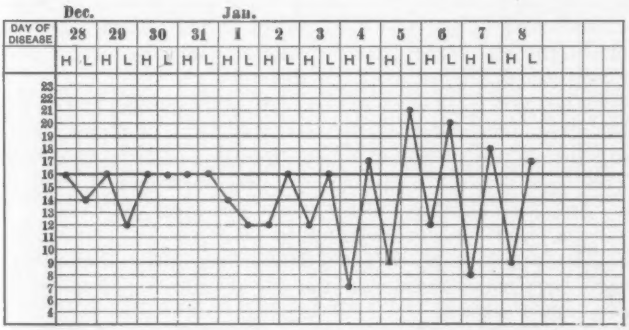


FIG. 2.—The respiratory rate during the second attack. H, high; L, low.

The patient was having what he called flushing attacks. On December 28 the pulse was 72 in the morning, the respirations 16, the temperature 97.3°. He was pale. Every little while his pulse would increase, then a flush would spread over the skin. The pulse would stop during the attack, then take up the normal beat. Arterial tension seemed increased. (Figs. 1 and 2.)

December 29. At 1 A.M. the pulse was 60. The patient was restless, wakeful, and had "flushing attacks." The pulse would beat regularly eight or nine times, followed by pauses of ten seconds, after which no acceleration of rate would occur. On December 30, his condition was much improved. After a comfortable night the pulse rate was 72.

On January 1, while sitting up, he had an attack of pulse intermissions lasting about half an hour, during which the arterial tension was high and the respirations slow and jerky. During this day the nurse's report shows that the pulse rate was very irregular; intermissions in the radial pulse lasting from four to twelve seconds were frequently observed. The pulse rate per minute ranged from 57 to 16, and the pulse waves were much fainter than heretofore. During the pauses pallor was extreme, the eyes fixed, the breathing slow and labored. When the pulse reappeared at the wrist a bright flush would spread over the face, and the pupils could contract and later again dilate. Curiously enough, the lips retained their color, and the hands their warmth during the intermissions, although the lower extremities were cold. During the intermissions the facial muscles would twitch and the eyeballs roll upward.

On January 2 the patient's condition was very alarming, pallor was extreme, the pulse very irregular, the skin was cold and clammy, and the patient was vomiting a yellowish liquid. One convulsion followed another, each lasting about twenty seconds. The jugular veins were prominent, and could be seen to pulsate more frequently than the radial pulse. On auscultation over the precordium feeble auricular contractions could be made out between the ventricular beats and during the long pauses. The ventricular sound was weak, the rate about 25 to the minute, while the jugular pulsations were ranging between 80 and 100.

The pulse in the right wrist was 63, without irregularity. The pulse of both wrists was taken together; the right was of larger volume. During the pauses of ten to twelve seconds, pallor was extreme, the eyes were set, the breathing was very slow and labored, not loud. The face became flushed when the pulse returned. The lips did not lose color, nor the hands warmth; the feet and legs were cold. The pupils were contracted after the flush, then dilated. During the pulse intermission the facial muscles twitched and the eyes rolled upward.

January 2, 1908. The patient's condition was very alarming. He was extremely pale. At this time the pulse became at times, very irregular. He started vomiting yellowish liquid, and was covered with a cold and clammy perspiration. One convulsion followed another, some lasting about twenty seconds. One could observe the jugular pulse in the neck, beating more rapidly than the radial pulse. The auricular contractions could be heard very

faintly, and the ventricular sound was also weak. The radial pulse was 25 to 30, the auricular beats about 80 to 100.

Drs. Alfred Stengel and William Pepper, of Philadelphia, and Drs. Thayer and Thomas, of Baltimore, were called in consultation and concurred in the diagnosis of heart block, positive proof of the condition being furnished by a pulse tracing made by Dr. Pepper. The patient's condition was still very alarming. Vomiting and convulsions kept up steadily. The pulse was weak and thready. After the convulsion the patient would complain of black specks flying before his eyes. Later on in the attack he complained of a lump in the stomach and cramps in the legs, which annoyed him considerably. Various kinds of treatment were administered, which will be discussed later.

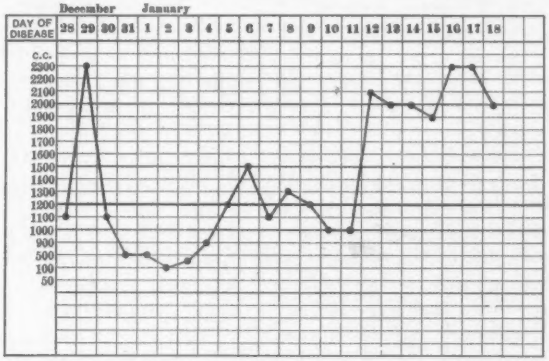


FIG. 3.—The amount of urine passed daily during the second attack.

At times the patient was excited and talkative on awakening. The secretion of urine at the beginning of the attack was high, but rapidly fell below normal for several days, then rose again (Fig. 3). Often during the attack the patient perspired freely. He suffered later in the attack from abdominal pain and distention, which gradually passed off. In his sleep he would jump and twitch, sometimes would mutter, talk, whisper, cry out, laugh, and pick at the bedclothes. The use of a bed pan would bring on convulsions, two of which were so severe he turned over from his back to his abdomen. The respiratory rate dropped as low as seven to a minute. Often the breathing became stertorous after convulsions, and sometimes was of the Cheyne-Stokes type. The temperature varied slightly during attacks, but remained subnormal. The *pulse rate was sometimes 11 to 12 to the minute.* The vomiting lasted until about January 6. At this date the radial pulse had reached 60, and there was a gradual, but steady, improvement.

On January 31 he was propped up in bed with pillows, and by

February 14 was sitting up in a chair. On February 21 he went to the Johns Hopkins Hospital, where he was under Dr. Thayer's care until about May 14. During his stay in the hospital he had several attacks, which will be reported by Dr. Thayer.

Last Attack. This attack began June 14, 1909, just about one month after his return from Baltimore, and lasted until August 8, 1909. Between attacks the pulse was ranged between 65 and 90.

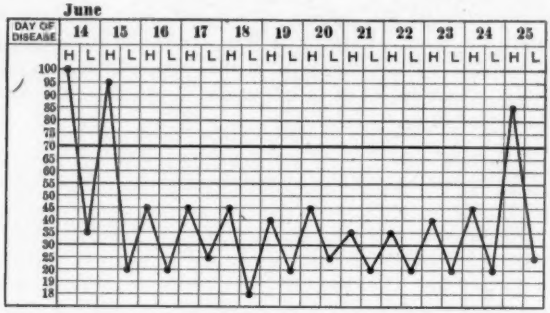


Fig. 4.—The diurnal variation of the pulse rate during the last attack. H, high, L, low.

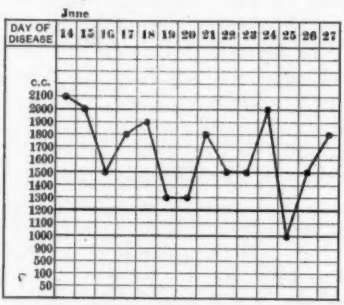


Fig. 5.—The amount of urine passed daily during the last attack.

After walking it would sometimes increase to 110 to 128 beats per minute. The treatment consisted of strychnine and infusion of scoparius. From June 14 to 23, during my temporary absence, he was under the care of Dr. George W. Norris and Dr. William Pepper. On June 13 the pulse was 88, the respirations 20, temperature 97.4° F. The next day at 6.15 A.M. the pulse dropped to 40. At times fifteen seconds would elapse between beats. The patient complained of pain in the abdomen and vomited at 7.45 A.M. After the vomiting the pulse became regular, 88 beats per minute. At 1.30 P.M. the pulse was 104. (Fig. 4 and 5.)

On June 15 (3.25 A.M.) there were *pauses in the pulse of ten to twelve seconds.* At 8.30 A.M. the upper and lower extremities

were cold. During this attack there was occasional vomiting. Very often after the vomiting the patient felt much relieved, and the pulse became stronger, but the rate remained unchanged. Often there would be an intermission in the pulse, followed by several very rapid pulsations. Once there was a period of unconsciousness lasting one minute. One of the convulsions lasting one-half minute, during which the face became purple, the mouth was drawn to the side, and eyes had a forced stare. On July 14 an erythematous rash appeared on the back, accompanied by intense itching, and on July 30 a similar rash again appeared. On each occasion he was taking strychnine. The patient during the most severe part of the attacks complained of red flashes before the eyes, which he said resembled tadpoles or question marks. He at times showed some depression just before attacks would come on. Even after the heart-block had subsided there was muscular twitching during sleep.

The patient passed through an uneventful convalescence. His weight from February 20 to August 14 had increased from about 165 to 192 pounds. There have never been any uncomfortable sensations referred to the heart. The pulse on December 16, 1909, was 88 per minute, regular, full, and strong. A faint systolic murmur was heard at the apex of the heart, but was not transmitted. The patient states that his hair, which had become rather white, has developed slightly more color, and that his skin has again assumed its normal rosy tint. At the present writing (December 16) he has apparently made a perfect recovery. Not only has he returned to business without any curtailment in ability to work, but a pulse tracing shows a perfectly normal heart action.

Treatment. During the first attack nitroglycerin was given, $\frac{1}{200}$ grain every two hours. This drug was also used for a time during the second attack. There did not seem to be any effect from its use on the pulse rate. Potassium citrate was used during the first and second attack as a diuretic. Atropine ($\frac{1}{150}$ or $\frac{1}{200}$ grain) was given in the second attack, but did not appear to affect the radial pulse materially. On the first day of the last attack Dr. Norris ordered atropine, $\frac{1}{60}$ grain, the dose being repeated four hours later. After the first dose the pulse remained at 24; when the second dose was given it rose to 90 beats. The pupils were dilated, the face was flushed, and the speech thick. At 9 P.M. the pulse again was 38 and the rhythm regular. Often during the attack the patient complained of uncomfortable sensations produced by atropine. Strychnine sulphate was used in all the attacks for its general tonic effect, but produced no noticeable benefit. Whiskey was employed for its stimulative properties, and I feel sure it had a good general effect. Morphine given hypodermically to quiet the patient, and for the relief of convulsions and vomiting, sometimes seemed beneficial. Oxygen was used

during the most severe part of the second attack, but as the relief produced by it was scarcely noticeable, it was discarded, as was also nitrite of amyl. Counterirritation to the epigastrium in the form of a mustard plaster failed to check the vomiting. Infusion of scoparius, which had been prescribed by Dr. Thayer, was continued for a time during the last attack, but did not seem to have either a beneficial or an untoward effect upon the heart-block. Quinine and caffeine were also tried. The effect of the latter is seen in tracings reproduced in Figs. 10 and 11. Massage seemed to improve the pulse volume temporarily and to add to the patient's comfort. Potassium iodide was tried and discarded. Aromatic spirit of ammonia had no effect on the heart-block. Cocaine and cerium oxalate were administered in an attempt to relieve the vomiting, without benefit. In short, none of the drugs employed seemed to have any effect on the heart-block, except in one instance in which large doses of atropine were temporarily followed by improvement. All medication was therefore stopped with the exception of an occasional dose of morphine.

The patient's condition remained unchanged, and on July 22 strychnine nitrate, $\frac{1}{30}$ grain, was ordered thrice daily. The next day the pulse rate ranged between 30 and 80, the latter rate being higher than it had been for some time previously. This rate persisted for five days, and finally on the 28th the pulse rate was found continuously between 88 and 90 per minute. Strychnine nitrate was continued until the end of August and gradually withdrawn. After July 28 there was no further evidence of heart-block.

Whether the administration of strychnine nitrate had any direct effect in causing the heart-block to disappear, I am unable to determine. The patient had been taking strychnine sulphate, earlier in the attack, for a long time without any apparent benefit; but immediately following the administration of the nitrate the heart-block began to disappear in a most pronounced and dramatic manner. This may have been pure coincidence, and from what we know of the physiological action of these two salts it is hardly reasonable to assume that so much difference exists in their action as the results would seem to justify. That such a possibility exists, however, I think cannot be positively denied, and I would suggest that strychnine nitrate be given a trial in all cases of heart-block, so that the question of its efficacy can be more definitely determined. Too short a time has elapsed for us to be at all sure that another attack of heart-block may not at some future time occur. In view of the fact that the patient has already had, and recovered from, such attacks would be a reason for expecting just such an occurrence. On the other hand, it must be borne in mind that none of the patient's recoveries were as complete as this last one. Until now he has never felt well, he has had twitchings in his sleep, and occasional dropping of the pulse rate

to 60; whereas now he once more feels that life is worth while, he has resumed his occupation, his pulse is constantly within the range of normal variation; in short, for the first time since his first attack in 1908, his health seems to be completely reëstablished.

Report by Dr. George W. Norris on the pulse tracings taken by Dr. Pepper and himself:

Fig. 6 (January 2, 1908) shows a complete heart-block. The auricle contracts from two to nine times as often as the ventricle.

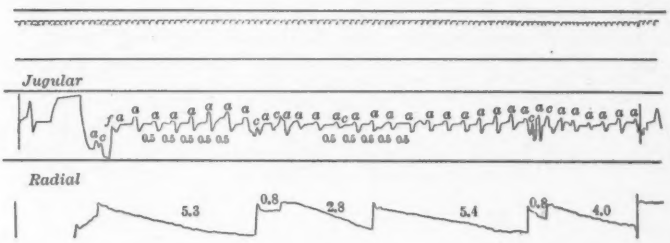


FIG. 6

Nearly 5.5 seconds elapse between some of the arterial pulses. The sinus rhythm (auricular cycle) is regularly 0.5 of a second. Two ventricular extrasystoles are seen on the tracing, conclusive proof that the excitability of the ventricle was not below par, and showing that the bradycardia was not due to depression of ventricular stimulability. Further substantiation of this statement is the fact that the block is a complete one, the auricular contractions therefore bearing no causal relations to the ventricular ones.

Fig. 7 (June 14, 1909) shows in every sense a normal state of affairs. Not only is there no arrhythmia of the brachial pulse, and

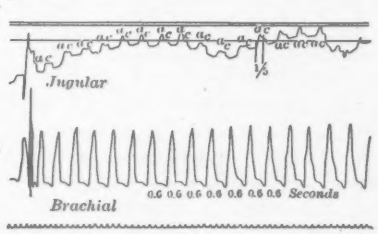


FIG. 7

no auriculoventricular dissociation, but the conductivity time—the *a-c* interval—is normal, occupying only 0.2 second. It has generally been believed that in cases in which the auriculoventricular bundle was sufficiently impaired in function to cause a temporary heart-block (even when the dissociation was not actually present),

a distinct lengthening of the time required for the contraction stimulus to pass from the right auricle to the left ventricle would exist. Such is, however, apparently not the case, as the foregoing tracing shows; for within twenty-four hours of the time when it was taken the patient was suffering from a complete continuous heart-block. We see, therefore, that the patient had at this time a normal auriculoventricular coördination; so that there can be no question of his having had an incomplete heart-block which had persisted since his previous attack, about two months ago. Such a state of affairs is possible, for incomplete heart-block may be present in unsuspected cases, and without giving rise to the symptoms which are characteristic of the Adams-Stokes syndrome.

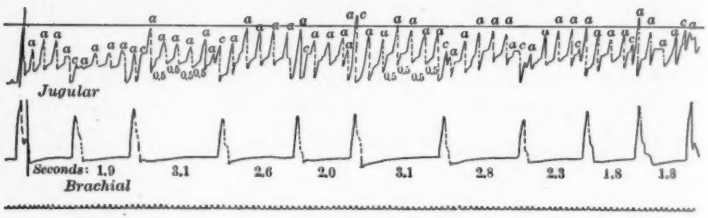


FIG. 8

Fig. 8 (June 15) shows a complete auriculoventricular dissociation. The auricle contracts from three to six times as often as the ventricle, and the contractions of these two chambers bear no constant or definite relation to each other. The ventricle has now initiated its own slow rhythm, and at one point in the tracing contracts at the same time as the auricle, producing a large summation or fusion wave. The radial pulse at the time this tracing was made was about thirty to the minute.

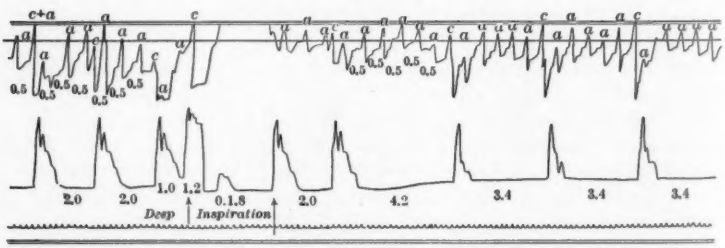


FIG. 9

Fig. 9 shows the effect of a deep inspiration upon the ventricular rhythm. The auricular rate was apparently unaffected (although during part of the time the tambour was forced beyond the tracing), but in the arterial pulse we find two extrasystoles following each

other in rapid succession, and then, after one normal ventricular contraction, a very prolonged pause (4.2 seconds); whether this change in the ventricular rhythm was from mechanical causes—due to an altered relationship between the intracardiac and intrapulmonic blood pressure—or whether it resulted from stimulation by the sympathetic nerve, it is difficult to determine. It is evidently not due to depression of the vagus nerve, since this nerve appears to act on the ventricles only secondarily to the auricles, and a state of block being present this influence of the auricles is excluded.

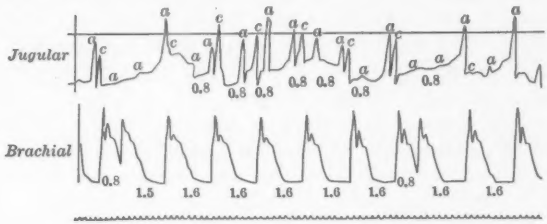


FIG. 10

Fig. 10 shows the complete auriculoventricular dissociation still persistent. The auricles are now contracting only about two or three times as often as the ventricles. On examining the time relationship of the auricular and ventricular cycles, we see that the former occupies 0.8 second, instead of 0.5 second, as in the previous tracings. The ventricular cycle, on the other hand, is diminished and requires only 1.6 seconds instead of from 2.0 to 4.2 seconds as heretofore. In other words, the auricular rate has diminished and the ventricular rate has increased. This was apparently the result of full doses of caffeine, which were administered to the point of producing wakefulness. Further evidences of increased ventricular excitability are seen in the occurrence of extrasystoles (two are seen on the tracing), which occurred very constantly during the next forty-eight hours. This result would seem to indicate that caffeine increases stimulus production and excitability in the ventricle. Further to be noted is the fact that the auricular cycle now lasts 0.8 of a second instead of 0.5 as heretofore. This is doubtless due to the withdrawal of the atropine, which, as is well known, increases the sinus rhythm by depression of the vagus nerve. On account of the patient's large chest and deeply placed apex beat, I was, unfortunately, at no time able to get a cardiogram, so that I was unable to study the presphygmic time, etc.

Fig. 11 shows the persistence of complete auriculoventricular dissociation and of the increased ventricular excitability—two-second intervals between arterial pulse waves and extrasystolic arrhythmia, producing a pulsus trigeminus and a bigeminus.

Fig. 12 shows that the extrasystoles have disappeared; radial pulse intermissions lasting from 1.8 to 4.4 seconds are again seen. Complete heart-block is still present.

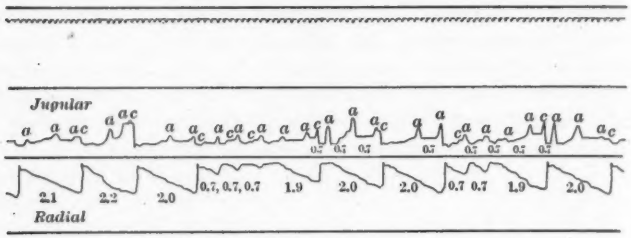


FIG. 11

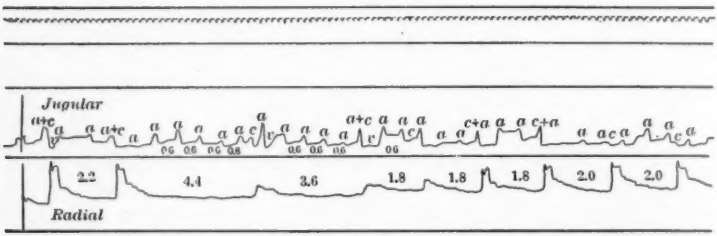


FIG. 12

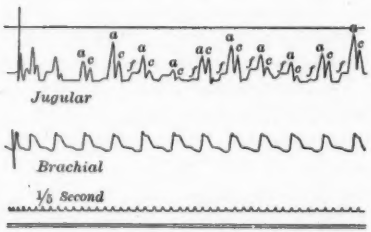


FIG. 13

Fig. 13 (December 15, 1909) was taken after a hard day's work, the patient being in good spirits and apparently in excellent physical condition. There is not only no auriculoventricular dissociation, but the conductivity time is normal, 0.2 second. The *a* wave in the jugular is perhaps a trifle larger than is usual, but otherwise no abnormality can be detected. The radial pulse was absolutely regular and 88 per minute.

It was quite astonishing to observe the way in which the blood pressure during all this attack had remained relatively near to the normal despite the enormous deviations in the rate of the arterial

pulse, yet this was uniformly the case, except on the day when the first tracing was made, in which the systolic pressure was very high and the diastolic very low. It should be stated, however, that I never happened to make a pulse tracing or take the blood pressure during those times at which the pulse was as low as 10 or 20 per minute. The lowest pulse rate which I had an opportunity of tracing was 24.

In endeavoring to explain this very extraordinary case, and elucidate the mechanism by virtue of which such a prolonged attack of complete heart-block could entirely disappear without leaving track or trace behind, in so far as our most exact methods can determine, we have indeed a perplexing task. The answer must necessarily be hypothetical until we possess a much more complete knowledge of cardiac physiology than is at present at our disposal. Quite a number of cases of heart-block have been carefully studied microscopically after death, and the following lesions have been described as being the cause of non-functionation of the auriculoventricular bundle: Fibrosis (Gibson,[1] Beeson,[2] Stengel,[3] Karcher and Schaffner,[4] Barr,[5] Fahr,[6] Turrell and Gibson,[7] Schmoll[8]), syphilis (G. C. Robinson,[9] Ashton, Norris, and Lavenson,[10] Hanford,[11] Vaquez and Esmein,[12] Keith and Miller[13]), fatty degeneration (Butler[14]), calcareous degeneration (Beck and Stokes[15]), thrombosis (Jellick, Cooper, and Ophüls[16]), atheroma of the vessel supplying the bundle with fibrosis (Hay and Moore[17]), ulceration,[18] atheroma of the vessel supplying the bundle and round cell infiltration of the bundle itself (Gerhardt[19]).

It is hard to conceive how organic changes, such as those just mentioned, could be recovered from, provided that they had been sufficiently extensive completely to destroy a cross-section of the bundle above its bifurcation or both divisions below this point, unless we are willing to accept the hypothesis that in cases of long-standing block the function of conduction can be assumed by parts of the myocardium other than the bundle itself, as was suggested by Heinike, Müller and Hösslin[20] in explanation of the second case studied by them. These observers suggest that inasmuch as the union between the auricle and ventricle is a very close one,

[1] Brit. Med. Jour., October 27, 1906.
[2] Jour. Amer. Med. Assoc., January, 1908.
[3] Amer. Jour. Med. Sci., December, 1905.
[4] Berl. klin. Woch., July 6, 1908.
[5] Brit. Med. Jour., 1906, ii, 1122.
[6] Virchow's Archiv, June, 1907.
[7] Brit. Med. Jour., November 14, 1908.
[8] Jour. Amer. Med. Assoc., February 3, 1906.
[9] Bull. Ayer Clin. Lab. of the Penna. Hospital, 1907.
[10] Amer. Jour. Med. Sci., January, 1907.
[11] Brit. Med. Jour., December 31, 1904.
[12] Presse méd., 1907, No. 8.
[13] Quoted by Robinson, loc. cit.
[14] Amer. Jour. Med. Sci., May, 1907.
[15] Arch. Int. Med., October, 1908.
[16] Jour. Amer. Med. Assoc., 1906, p. 955.
[17] Lancet, November 10, 1906.
[18] James, Amer. Jour. Med. Sci., 1908, cxxxvi, 469.
[19] Deut. Arch. f. klin. Med., 1908, xciii, 5 and 6.
[20] Ibid., 459.

so close, indeed, that it is sometimes difficult to demonstrate any dividing connective tissue, it is possible that in cases of long-standing heart-block some of the muscular fibers outside of the bundle might assume a compensatory function and conduct the stimulus from the auricle to the ventricle. This does not seem to be a satisfactory explanation, since the fibers of the bundle normally seem to be highly specialized and quite different in appearance from the ordinary cardiac muscle tissue. Furthermore, Erlanger's[21] recent researches seem to show that functional union cannot be reëstablished between two parts of the heart the functional continuity of which has been completely severed. But, on the other hand, we must bear in mind that we have still much to learn regarding not only the physiology, but even the anatomy of the auriculo-ventricular bundle. Thus, only recently Curran[22] has found in human, in calves', and in sheep's hearts a bursa which is in constant relation to the bundle, which would facilitate the extension of infection from the endocardium, and which, in the event of a bursitis, might greatly impair its function. The mere existence of the bursa would seem to indicate that either the bundle did not contract at all or that it contracted differently from the rest of the heart muscle. If the lesion had been a gummatous one, it is conceivable that antisyphilitic treatment might have restored the function of the bundle, but in the present case lues could be excluded, the administration of iodide was useless, and the patient did not recover during or even soon after its employment. (Recoveries as the result of antisyphilitic treatment have been reported by Schmaltz[23] and Erlanger.[24]) Some investigators believe that conduction through the bundle is nervous in character and not muscular at all. This view is not generally accepted, although the supporters of the myogenic hypothesis readily admit that stimulation of the vagus nerve depresses the function of conductivity. (This has been shown by Gaskell,[25] and by Mackenzie.[26] Furthermore, digitalis, which acts upon the heart mainly through depression of the vagus, is known to depress this function in cases in which it is already below par, thus producing digitalis heart-block.) Then again a vagus block would have been more likely to be incomplete, and intermittent. If the heart-block in the present case had been the result of overaction of the vagus it would have disappeared or at least shown some improvement under the large doses of atropine which were administered, whereas it remained absolutely unaffected, except for one temporary rise in pulse rate, even while the full physiological effects of the drug were manifested throughout the rest of the system.

[21] Amer. Jour. Physiol., July, 1909.
[22] Anatom. Anzeiger, 1909, xxxv, 89.
[23] Münch. med. Woch., 1905, p. 1120.
[24] Jour. Exper. Med., 1906.
[25] Text-book of Physiology, edited by Schaefer, vol. ii.
[26] Manchester Med. Chronicle, September, 1906.

Wiesel[27] has described three cases of coronary sclerosis, with symptoms of angina pectoris, in which there was extensive fibrosis of the bundle both above and below its bifurcation, in which none of the symptoms of the Adams-Stokes syndrome had occurred. In such cases, however, it is often difficult to be sure that all of the fibers have been destroyed, and that the functionation may not have been due to a few healthy fibers.

Transient heart-block sometimes occurs during or shortly after an attack of infectious disease, and in such cases is evidently the result of a toxemia[28] or inflammation.[29] No such explanation could be applicable to the present case.

Belski[30] has reported a case of heart-block in which a temporary restoration of conductivity was noted, although the *a-c* interval remained prolonged throughout, and a slight exertion, such as sitting up in bed, would again bring on the block. Among the three cases recorded by Gerhardt, in which a heart-block disappeared after existing for some time, there was one which had some similarity to the present case. The patient was a woman, aged sixty-five years, in whom complete block alternated for several days with normal auriculoventricular coördination, and finally disappeared altogether. The patient was the subject of arteriosclerosis, a process in which the auriculoventricular bundle probably shared. This second of Gerhardt's cases is the only one which I have been able to find in the literature which resembled Dr. Earnshaw's case, and this one was of much shorter duration and of less intensity.

Herrick[31] recently has reported a case presenting some points of similarity to that herewith reported. Although Herrick's patient seems to have made a symptomatic recovery, the phlebogram discloses a permanent depression of conductivity.

From a study of the hitherto reported cases of the Adams-Stokes syndrome, both those with and without autopsy reports, it would seem that the auriculoventricular bundle may be more or less destroyed by pathological processes without giving rise to dissociation. So long as there are some healthy fibers left, they seem to be capable of conducting contractile impulses. It also seems to be shown, that these remaining fibers may temporarily lose, and subsequently regain, their function as the result of a number of factors, such as drugs, toxemias, inflammation. It is reasonable to suppose that when a transient heart-block occurs in a patient of advanced years there is some organic, probably arteriosclerotic, change in the bundle; and that the block occurs by virtue of some superadded factor which has deranged its nutrition.

[27] Kongr. f. inn. Med., 1907, p. 628.
[28] Joachim, Deut. Arch. f. klin. Med., 1907, lxxxviii, 4 to 6.
[29] Gerhardt, Ibid., 1908, xciii, 5 and 6.
[30] Zeit. f. klin. Med., vol. lvii.
[31] Amer. Jour. Med. Sci., 1909, cxxxix, 246.

The most reasonable explanation which we have been able to formulate in explanation of the present case has been a vasomotor one, probably engrafted upon some sclerotic change in the bundle or its nutrient vessels. The auriculoventricular bundle is, of course, nourished by definite branches of the coronary artery. Vascular sclerosis is often curiously localized in distribution. Thus, in the field of medicine which we have been considering Karcher and Schaffner found the bundle well preserved in a case of high-grade coronary sclerosis, and Aschoff describes well-marked arterial disease affecting the small arteries which supply the bundle, and yet the bundle itself was in an apparently healthy condition. It is conceivable that if for some reason the blood supply of the bundle was temporarily cut off or diminished, it would cease functionating as long as the anemia kept up, and again take on its normal activity when its blood supply was reëstablished. That there may have been some such diminution of blood supply resulting from round-cell infiltration, arterial spasm, or constriction, or alteration in local blood pressure, would be nearly as difficult to deny as it would be to prove. At all events, this seems to be the most rational explanation which can be offered to explain the case in question.

I wish to express my indebtedness to Drs. Norris, Stengel, Pepper, and Thayer for their assistance in the study of the case.

A CLINICAL STUDY OF TWO CASES OF CARDIAC DEATH.

By James D. Heard, M.D.,
Associate in Medicine in the University of Pittsburg.

Much remains to be determined regarding the causes of cardiac complications arising during the course of, or following, the acute infectious diseases. A great deal of light is being thrown upon this subject by the experimental studies of Pearce,[1] Fisher,[2] Welsh and Flexner,[3] Bolton and Bown,[4] Fleischer and Loeb,[5] and Sharp.[6] Postmortem investigations in the infectious diseases have demon-

[1] A note on the Production of Vascular Lesions in the Rabbit by Single Injections of Adrenalin, Albany Med. Annals, xxviii, 51.

[2] Ueber Arterienenkrankungen durch Adrenalin Injectionen, Münch. med. Woch., 1905, iii, 928.

[3] Histological Changes in Experimental Diphtheria, Bulletin Johns Hopkins Hospital, 1891; The Histological Changes Produced by the Toxalbumin of Diphtheria, ibid., 1892, iii, 17.

[4] Pathological Changes in Central Nervous System in Experimental Diphtheria, Brain, xxx, 365.

[5] Archives Int. Med., iii, 78.

[6] Jour. Anat. and Phys., 1897, xxxi, 199.

strated profound changes in the heart muscle, as the result of the action of the various microbiotic poisons. These conditions are analogous with changes occurring in the skeletal muscles in like disorders. The first studies upon the condition of the heart muscle in infections were made in a case of typhoid fever, but the most minute observations have been carried on in regard to diphtheria. In diphtheria, in addition to myocardial changes, there has been demonstrated degeneration of the medullary centres, of the peripheral vagus, and of the cardiac plexus (Vincent and P. Meyer). Romberg and Paessler have pointed out that the circulatory disturbances which arise in animals infected with pneumococcus, Bacillus diphtheriæ, and Bacillus pyocyaneus are caused almost exclusively by central paralysis of the vasomotor apparatus.

In applying observations made on pneumococcic septicemia in animals to human beings afflicted with pneumonia, it must be remembered that in pneumonia the condition is not quite analogous, since in this an additional strain is thrown on the heart by reason of obstruction in the pulmonary circuit. Krehl[7] concludes his discussion of the subject of cardiac involvement in diphtheria by saying that all that we can state definitely at present regarding the subject, is that the diphtheria poison injures the heart muscle and the vasomotor apparatus. It is probable that in the near future further studies in experimental myocarditis, induced by the injection of adrenalin or by inoculation with toxins, will throw additional light upon the matter.

The interest of this subject lies not alone in the field of the experimental physiologist and of the pathologist. The clinician must add his observations as to the effect which these poisons produce upon the living as demonstrable at the bedside. The symptoms of cardiac involvement are not infrequently somewhat obscure; yet, if such signs as are present be disregarded, there may occur an unexpected and perhaps an avoidable death, which, by careful examination, could have been at least foreseen.

Case I.—M. J., a female, aged six years, a well-nourished child, with no history of previous severe illness. She was first seen October 5, 1906, when she was found to have typical tonsillar diphtheria. Diphtheria bacilli were subsequently demonstrated in pure culture. On the following day the exudate had spread to the pharynx. There was moderate toxemia. The urine was normal. The heart sounds were markedly clear, and the pulse regular and full. The fever was not at any time high. Antitoxin was administered on this and on the succeeding day—6500 units in all—after which the child began to improve, and by October 10 she was practically well; the exudate had disappeared; the temperature had fallen to normal; the general condition was so good that

[7] Diseases of the Heart, Nothnagel's Encyclopedia, 635.

the parents regarded the little patient as well. As yet there was no circulatory change demonstrable.

On October 11, in the evening, the child complained of feeling chilly, but did not have a true rigor. She had been particularly cheerful all day. The evening was cool; so she was wrapped in a blanket and was soon quite comfortable. On October 12 she had a sudden attack of severe epigastric pain with vomiting; these symptoms continuing throughout the day. There had been no indiscretion in diet and her bowels had been moving freely. A physical examination showed that the heart sounds had become muffled, and it was noticed that the radial pulse was markedly arrhythmic. The child's face was pale and anxious, and the skin surface was decidedly cool. The examination of the abdomen showed epigastric tenderness, but was otherwise negative. The family was warned of the danger, and instructed to keep the patient absolutely quiet upon her back, to have some one person with her constantly, and to avoid all excitement. The use of the bed pan was insisted upon. The further course of the case was as follows:

On October 13 vomiting and pain were still present, but they were of a less severe nature; the pulse was very weak and intermittent; the heart impulse was weak, the muscular sound poor, but no murmur was audible.

On October 14 improvement continued; there was no pain; there was occasional slight vomiting, but nourishment was retained fairly well; the bowels moved; the pulse was of better quality. In the evening the child was left alone for a short time by the member of the family who was acting as nurse. The patient called, and, receiving no answer, became much excited, screamed violently and repeatedly, and, when the nurse returned, was so nervous that "she shook all over," and could not be quieted for a long time.

On October 15, when she was seen about midday the condition was fairly good; she had slept the greater part of the night, the pulse was somewhat better in quality than it had been previously; but the heart sounds were muffled, and the beat irregular as to rhythm and force; no murmur was heard. One hour later I was called hurriedly and found her in collapse. Her nurse, on being questioned, said that at about 12.30 the child had called out that she was about to have a movement of the bowels. The bed pan was brought, but she became greatly excited and insisted on being allowed to sit up. This the nurse (a sister) finally allowed her to do, although she had been fully warned against the danger of such proceeding. Almost immediately the little patient gave a long sigh, her arms dropped to her sides, she became deathly pale, and could return no answer to the frenzied questions put to her. She died at 4.30 P.M., never having reacted nor regained consciousness.

The case appears to be a typical one of cardiac death occurring in convalescence from diphtheria. Only a few points of interest will be considered in regard to it.

Time of Appearance of the Cardiac Symptoms. Two forms exist, an early and a late. Heart failure in the acute stage is seen only in the severest forms of infection. It may occur without warning, or there may be prodromal signs of failure of the circulation. Death in convalescence may be sudden, but is more frequently preceded by signs and symptoms of abnormality of heart action. "But the most curious thing is that, for a long time, weeks after the disease itself has run its course, and when the patient is convalescent there is still danger of the occurrence of severe circulatory disturbances" (Krehl[8]).

Danger Signs. Vomiting is, as a rule, an indication of the beginning of degeneration of the vagus nerve. "There is no one symptom in the convalescent stage of diphtheria which is of so grave import as a sudden unexplained attack of vomiting. Very few patients in this condition recover" (McCollum[9]). Other serious symptoms are marked pallor, coming on perhaps suddenly, and abdominal pain and tenderness. Among the dangerous cardiac symptoms are an increase in frequency, or a marked slowing of the heart beat. Irregularity of force and rhythm, with a muffling of the muscular sounds are always to be taken seriously as of bad prognostic omen. The association of gallop rhythm with late vomiting renders the outlook almost hopeless (White and Smith[10]).

Frequency. Romberg and Schmaltz claim that circulatory disturbances occur in 10 to 20 per cent. of all cases of diphtheria.

Effect of Antitoxin. Authorities diagree. Krehl[11] says that as far as can be judged, serum treatment has no appreciable influence upon the frequency of circulatory disturbances. White and Smith[12] conclude that antitoxin does not affect the heart, unfavorably, but that, on the other hand, its early use prevents the appearance of grave heart complications. Rosenau and Anderson[13] have reported the remarkable prophylactic effect of the early use of antitoxin against postdiphtheritic paralyses in guinea-pigs.

Treatment. When severe heart complications have developed, absolute rest in bed and absolute avoidance of excitement, perhaps for weeks, are necessary. One may, however, be governed somewhat by the stage of the illness and the general condition. If no serious trouble has developed within four weeks the patients are, as a rule, safe from this complication (White and Smith). They are not, however, entirely out of danger.

Action of the Toxins and Microörganisms upon the Circulatory Apparatus. The infection is frequently mixed—a fact which complicates the problem. Baginsky[14] says: "If we ask ourselves what anatomical change the heart muscle in these conditions and

[8] Loc. cit.
[9] Modern Medicine, ii, 416.
[10] Communications of Mass. Med. Soc., 1904. Quoted by McCollum, loc. cit.
[11] Loc. cit., 637.
[12] Loc. cit.
[13] Trans. Assoc. Amer. Phys., xxii, 26.
[14] Mod. Clin. Med., p. 516.

processes has suffered we would be greatly mistaken if we assumed that they are always very marked or constantly of the same nature. Occasionally, in fact, nothing is found which could at all explain the loss in the action of the heart; and this is especially the case if death has occurred quite rapidly. In these cases, probably, lesions of the cardiac nerves and ganglia arise which can only be demonstrated with the greatest difficulty. On the other hand, however, there is found, especially in those cases in which the agony has lasted some time, and in which the improved conditions have varied with renewed collapse, the grossest changes in the heart muscle; fatty degeneration of the muscular structure, gross changes in the nuclei of the muscles, and complete fragmentation or hemorrhagic dissemination of the muscular tissue, and with this adhering thrombi which have most probably occurred during life."

The theory of Eppinger is accepted by Trumpp[15]—that of a separation of the fibrils of the heart muscle from their sheaths—a myolysis from toxic œdema. Adami[16] regards vagus degeneration as the most satisfactory explanation of the sudden deaths which occur in diphtheria. His is a view to which I incline, as best explaining the terrible sequel of this case.

Case II.—Miss P. Y., aged fifty-four years. She had been a healthy child up to her ninth year, at which time she had an attack of scarlet fever, moderate in its severity. There were apparently no complications, and she was subsequently in good health until three years later, when she passed through a severe attack of diphtheria. She was confined to her bed for four months. The cause of this protracted illness is unknown, but the family states definitely that there were no paralyses. A short time after she was able to be on her feet again, she began to suffer from severe attacks of asthma, usually lasting for three or four days. During the intermissions, of several weeks' duration, she was entirely free from respiratory disorder. She never, however, regained her previous bodily strength.

When twenty years of age she began, for the first time, to complain of palpitation during her asthmatic attacks, although she continued free of cardiac symptoms during the intermissions. Following a change of dwelling to a somewhat higher altitude, the attacks of asthma and palpitation greatly diminished as to frequency, and she had comparative freedom for nearly twelve years, when the symptoms of cardiac insufficiency began to return, and to assume the major role. She still had attacks of asthma and suffered from bronchitis and emphysema; but the heart was evidently somewhat crippled at this time, for she was very short of breath on exertion, and œdema set in. There were frequent attacks of tachycardia, and the family later began to notice a dusky color about her lips and

[15] Diseases of Children, Pfandler and Schlossman, ii, 386.
[16] Principles of Pathology, p. 433.

fingers. Her asthmatic attacks were comparatively infrequent from this time on, but the cyanosis became so marked that a sister described her as having times when her hands would be "black to the knuckles." The latter condition set in about two years before her death, and had no relation with her attacks of dyspnœa. During the last few months there were "two occasions when the forehead and cheeks became almost black." She complained of dyspeptic symptoms and of pain in the right hypochondrium. During the two months before her death, her sister noticed a throbbing of the veins in her neck—this an independent observation and not the result of a leading question. The skin was always sallow. She began to be apathetic, but in spite of her discomfort was able to attend to light duties about the house.

I was called to see her on March 6, 1909, and found her walking about her room in great respiratory distress. Her face and finger nails were livid, the general surface dusky, and the conjunctivæ icteric. She was troubled with frequent cough, and was expectorating a viscid, blood-stained mucus. Physical examination revealed a general arteriosclerosis, a radial pulse of marked irregularity and weakness, throbbing jugulars (ventricular venous pulse), an apex beat diffuse in the fifth and sixth interspaces somewhat within the nipple line. The transverse area of cardiac dulness extended from three and one-half finger breadths to the right of the sternum, to the left nipple line. The lungs showed evidence of chronic bronchitis. There were also many piping asthmatic rales. There was an area of beginning consolidation at the right base posteriorly. Examination of the heart showed a tumultuous irregular action, the muscle sound very poor—apparently a soft, systolic murmur at the apex and over the lower portion of the sternum. It was difficult to be certain of this, as the conditions for examination were exceedingly unfavorable. There were very poor aortic and pulmonic second sounds. The liver extended to the level of the umbilicus, was tender to the touch; no pulsation could be detected. An extremely unfavorable prognosis was given owing to the patient's age and to the condition of the heart. Her family was warned of the danger of sudden death.

When she was seen next morning the patient's mind was relatively clear. The temperature was 102°. There was little evidence of toxemia. The heart conditions had remained apparently unchanged. The consolidation at the right base had increased in area, and a beginning involvement of left base was apparent. A few hours afterward the very competent nurse in attendance took the patient's pulse and found it unchanged. She stepped into the hall and was absent, she says, but a minute. When she returned she was shocked to see the patient evidently in a dying condition. In a minute or so breathing had ceased.

I will not attempt to discuss this case in detail, but only in rela-

tion to the cardiac complication. As the patient was not seen until near the termination of her case, and as any conclusions which are drawn must rest upon the history and upon the untrained observations of members of her family up to the appearance of her terminal pneumonia, a complete diagnosis of her condition was beset with many, perhaps insuperable, difficulties. Further, the presence of her pneumonia and of her excessively weak heart, masked certain symptoms and made perhaps of doubtful import such others, as the enlargement of the liver, the jaundice, the cyanosis, and the increase of cardiac dulness to the right which was present at the time of examination. A point which, from a study of her history, strikes me at the very beginning, is the comparatively late period at which symptoms of a failing circulation began to develop—that is, the amount of work which a weak heart may be able to perform.

That the original cause of weakness of the heart muscle may be traced to the diphtheria forty years before seems not impossible. We have noted that at that time the patient had been confined to her bed for four months. It is stated quite definitely by an intelligent member of the family that there were present no paralyses to account for this long illness. The known frequency of myocardial complications in the disease under consideration makes it, therefore, not unlikely that to a damaged heart muscle must be attached the blame of this protracted convalescence. The duration of the illness corresponds with the course of myocarditis of convalescents, some cases of which are often protracted for weeks, or even months.

The important point to be considered is, whether a myocarditis arising in childhood could affect the heart during so long a period as forty-two years. As bearing upon this point I quote from Krehl:[17] "The restitutio ad integrum in many cases of diphtheritic heart disease that end in recovery is so complete that an ordinary physical examination reveals nothing whatever. But it is a question, nevertheless, whether the heart is really absolutely sound, expecially whether it has the same functional capacity as before, or, in other words, whether its capacity is adequate to the demands incident to the individual's mode of life. The more we study heart diseases the more we are impressed with the extreme complexity of the etiology; an infectious disease that has run its course many years before a definite disease of the heart develops, appears, nevertheless, to be capable of influencing the development of this disease, although the interval between the two events may have been marked by perfect health. Possibly the first disease prepared the soil for the second."

We note that for eight years after her diphtheria the patient had no cardiac symptoms, or, at least, none that were observed. During this time, she was greatly troubled by attacks of asthma, the pre-

[17] Loc. cit., 638.

disposition to which disease may have arisen through catarrhal conditions of the respiratory mucous membrane resulting from her diphtheritic infection. It is possible that the cardiac affection was responsible. The long period of asthma without apparent cardiac inadequacy, and the fact that the asthma diminished as the heart became less and less able to carry on its work, suggest, however, that some exciting cause was present outside of the myocardium. It may be noted as a matter of interest that McPhedran[18] claims that true asthma is very rarely due to diseases of the heart. Jellenk and Cooper[19] suggest that cardiac asthma may arise in certain instances as a right-sided angina. Whether we consider the asthma of cardiac origin or not, it is certainly of interest that, for over a period of many years, circulatory disturbances played only a secondary role in the clinical picture, and that it was not until the later years of her life that symptoms of cardiac incompetence became of overshadowing importance. A longitudinal section of her history shows us, then: a period of eight years of asthma without circulatory disturbances; thirty-two years of asthma with coincident cardiac distress but freedom between attacks; and a later period during which the asthmatic attacks became less frequent while the trouble with the heart increased. We have learned that it was only during the last two years of her life that marked cyanosis became noticeable to the untrained members of her family, but that the marked pulsation of the veins of her neck were visible for two months before her death.

What had happened to the heart during this period? To an organ which we have assumed to have been early weakened by a toxic myocarditis and later to have participated in a general condition of malnutrition, which we have seen existed since her twelfth year, has been added a frequently recurring strain. The cardiac strain in asthma falls particularly upon the right heart, and in the patient under consideration the throbbing veins of the neck and the attacks of extreme cyanosis with subicteric color of the skin and conjunctivæ, noted by the family, give support to the view that during the later period there was a gradually increasing dilatation of the right ventricle with resulting incompetence of the tricuspid valves. The marked congestion of the liver observed at the time of examination and the history of right hypogastric pain give some further support to this view.

Further cause of dilatation of the right heart may have existed in an insufficiency of the mitral valve. Clinical proof of such condition is wanting; but, when we remember how often a muscular insufficiency of the mitral valve exists, even in a pure myocarditis, and when we further consider the frequency with which myocarditis and true endocarditis co-exist, it would certainly have been quite

[18] Modern Medicine, iii, 712.

[19] Amer. Med. Jour., vol. l, No. 9.

within ordinary experience to have had such cause of pulmonary engorgement present in this case. That no mitral murmur was heard at the time that the patient came under observation could not, of course, exclude such condition.

Finally, a persistent low blood pressure may have been an additional cause of weakness of the heart muscle as a whole. How much, if any, of this was due to vasomotor influences and to a massing of blood in the splanchnics cannot be determined. We can only say that at the beginning of the patient's pneumonia she had a very low arterial pressure, and that it is not unlikely that such a condition had been present for some time. Here, then, we would have a possible establishment of a vicious circle, for, as soon as the left ventricle can no longer maintain a sufficient degree of pressure in the aorta to maintain the requisite pressure in the coronary artery, the myocardium suffers from hyponutrition at the very time when it can least afford to dispense with its proper supply (Hoover[20]).

Then as a last straw comes pneumonia, with a toxin in the circulation capable of further damaging the heart muscle, and an added work is thrown upon the already weakened right ventricle by reason of the obstruction in the pulmonary circuit. That the heart could not respond to this additional call is shown by the weakness of the pulmonic sound throughout.

I have spoken of dilatation of the right ventricle resulting in failure at closure of the tricuspid valves—a relative incompetence which is almost the only form seen developing in adult life, except in connection with previously existing valvular disease involving other valves of the heart. The mechanism of this functional incompetence is, that as the dilating right ventricle expands, the fibrous ring surrounding the auriculoventricular orifice becomes stretched. A larger opening is thus formed, and as the chordæ tendinæ cannot elongate, the cusps can no longer meet in close apposition. Further, "It is a question whether the inability of the muscle to lessen the ventricular cavity to its normal size in systole does not play a large, if not the chief part, for if at the height of systole the cavity were no larger (than normal), it is conceivable that even with a dilated ring no regurgitation might occur; but if with a dilated ventricle the degree to which the ventricle can contract be lessened, then the cavity is fuller at the end of systole than normal, and the valve cusps are not properly approximated" (Osler[21]).

Summary. It may, therefore, be concluded with a fair degree of certainty that the cause of death was incompetence of a heart muscle, probably the seat of a chronic myocarditis. This condition may have originated at the time of the infection with diphtheria during childhood, or, at least, the soil may have been prepared at that time for subsequent cardiac disease. That the scarlatinal infection may have

[20] Modern Medicine, iv, 31.

[21] Ibid., 240.

exerted some unfavorable influence cannot, of course, be denied. At any rate, owing to repeated strain and to various unfavorable conditions there gradually developed the incompetence of the muscle for the work required of it. Dilatation of the right ventricle set in, with relative insufficiency of the tricuspid valves; the fatal end was precipitated by a sudden increase in resistance in the pulmonary circuit, with possibly a further weakening of the muscle as a result of the action of the toxic products of a pneumococcic infection.

It is regretted that autopsies could not be obtained in either of the above cases; but, since the wide field of speculation into which a bedside study of certain heart cases may lead us opens up many subjects which even a careful postmortem examination might fail to make wholly clear, their report seems, nevertheless, justifiable.

INFLUENZAL SEPTICEMIA.

By James D. Madison, M.D.,

PROFESSOR OF MEDICINE IN THE MEDICAL DEPARTMENT OF CARROLL COLLEGE, MILWAUKEE; ATTENDING PHYSICIAN TO THE MILWAUKEE COUNTY HOSPITAL.

The invasion of the deep tissues and the blood by the influenza bacillus has been a matter of much doubt, and up to recent times has received but little bacteriological confirmation. That it does more or less frequently invade the blood stream can no longer be doubted. When we consider the accumulating evidence of the comparative frequency among severe influenzal infections, of such complications as endocarditis, arteritis, phlebitis, arthritis, etc., we must be impressed, I think, with the probable frequency with which this organism finds its way into the blood and there succeeds in living and multiplying. Doubtless a simple transmission by the blood to other parts, without the organism actually growing in the blood, may occur.

One striking feature noted in connection with certain cases of the grip is the marked prolongation of the fever, suggesting the continued operation of the organism in the tissues rather than a mere delay in the recovery from an infection lasting only a few days. In many of these prolonged attacks there has been no bacteriological evidence forthcoming to prove what organ formed the nidus of the bacillus. However, in not a few there has been demonstrated a definite complication, such as otitis media, pleurisy, pneumonia, pericarditis meningitis, arthritis, etc., and from these has been isolated the influenza bacillus. There are still other cases of prolonged fever in which none of these complications appear, or at least play a minor

part, and some of these have been shown to be true influenzal septicemia. These are the cases which resemble closely typhoid fever or other infections such as miliary tuberculosis. That these cases have been long wanting an explanation we can readily understand when we consider the comparative difficulties in the way of obtaining these organisms in cultures.

The following case represents a prolonged influenzal infection in which there was a primary bronchopneumonia followed by invasion of the blood and ending in recovery.

V. A., a female, aged thirty-eight years, married; the family history is unimportant. She never had typhoid fever, nor had she been troubled with a chronic cough. During the latter months of her only pregnancy she suffered from a "milk leg" on the left side, from which she recovered completely. The present illness began December 12, 1906, while on the train going to a nearby town. She became chilly, felt badly all over, experienced a sort of numb sensation, and was nauseated and vomited. On reaching her destination she found it necessary to go to bed. A physician was called, and found her with a high fever and severe pains all over the body, and spoke of her having rheumatic fever. On December 18 she returned to Milwaukee, and when seen by a physician had a temperature of 103.8°, complained of extreme general malaise, and looked very ill. There was some cough and a little expectoration, no diarrhœa, but at first some pain over the lower abdomen. The patient was seen with Dr. McNaughton on December 21. She then seemed feeble and very ill. There was some cough, and she was expectorating a moderate amount of brownish or bloody sputum. She complained of a sharp pain in the right side on coughing or taking a deep breath. There was no abdominal pain and no diarrhea.

The patient was a small, frail woman. The chest was poorly formed and bony. On the left side nothing abnormal was found beyond an occasional rale. On the right side expansion was slightly lessened, but the percussion note and vocal fremitus seemed nowhere distinctly abnormal. Over the front, at the apex, and especially at the level of the third and fourth ribs, many crackling rales were heard, some quite coarse. In the right axilla a well-defined friction rub with some fine crackles was heard. Behind and especially in the lower interscapular region a good many rather coarse rales were noted. No tubular breathing or exaggerated voice sounds were anywhere present, though the breath sounds were relatively suppressed. The abdomen was flat, not tender, and there were no rose spots. The spleen was not palpable, but the area of splenic dulness was somewhat increased. The leukocyte count was 7500 and the Widal test negative. The sputum was moderate in amount, tenacious, and at first distinctly brownish and blood-stained. During the following month the patient's general condition showed no improvement, though the lung symptoms had very distinctly abated.

The cough and expectoration gradually lessened and practically disappeared. The friction rub on the right side had disappeared, and nearly all the rales were gone. There was still some deficiency of breath sounds on the right side. The spleen remained about as noted and no rose spots were seen at any time. She continued to have fever which, however, it was not possible to observe as accurately as was desirable. During this time the temperature was quite irregular, rarely touched normal, often rose to 102° to 103°, and for the most part showed an afternoon rise. There were periods when, on the whole, the fever showed abatements. Its total duration was about sixty-eight days.

On January 21 some pain was complained of in the right groin, and on the next day the region below Poupart's ligament was tender and rather diffusely swollen. In the region of the femoral vein a painful enduration 10 cm. long could be made out. The femoral artery at this point could be felt pulsating, as also could the post-tibial and dorsalis pedis. The whole limb was slightly swollen, but it was most marked about the foot and ankle. At the end of a week the pain and swelling had somewhat lessened. At 7 A.M. January 29, the patient experienced a chill which lasted some minutes. The next morning, and again at 6.30 P.M., there was a severe chill, each being followed by a high fever. During this period the fever was particularly irregular, ranging between 98° and 106°. On February 3, an arthritis developed in the left wrist. The wrist became red, swollen, and painful. This condition increased in intensity and the patient complained of much pain. A considerable boggy swelling developed, but on aspiration no fluid could be obtained. The patient was moved to the Milwaukee Hospital on February 16. At this time her general condition had distinctly improved; the temperature was ranging between 98° and 100°. The right leg was still distinctly swollen, the induration was readily made out in the groin, and could be distinctly traced to the popliteal space, where there was induration, pain, and tenderness. The left wrist was now much better, though there was still distinct swelling on the dorsum and limitation of motion.

During the following month both the wrist and the leg improved slowly but continuously, and at the end of six to eight months both conditions were entirely well. There was no fever after February 17. The cough had entirely disappeared, the condition of the chest was about normal, and when examined two years later, the lungs and the heart were normal, as also were the right leg and left wrist. The Widal test taken on subsequent occasions was negative for both typhoid and paracolon bacilli. The urine examinations showed nothing abnormal of importance beyond a trace of albumin.

Smears from the sputum stained by Gram's method and counterstained with Bismarck brown showed a variety of organisms, the vast

majority of which were a small non-Gram staining bacillus having the morphology of the influenza bacillus. Cultures from the sputum were made on blood agar in the usual way and the influenza bacillus was quite readily grown and isolated in pure culture. A good many other organisms grew and among them were colonies of pneumococci, but the scarcely visible colonies of the influenza bacillus vastly predominated. Repeated examinations were made for tubercle bacilli, but none was found. On February 2, about an ounce of blood was obtained from one of the large veins of the arm. Portions of this were transferred to three blood agar tubes and a bouillon tube; at the end of thirty-six hours the cultures in the agar tubes showed many colonies just visible in a proper light and under a lens, resembling very much small drops of dew. No other colonies were present. A growth of influenza bacilli was also obtained in the bouillon. On being transferred to other blood agar tubes a faint growth was again obtained, but on plain agar no growth appeared after several days in the thermostat. A smear from these fine colonies showed a small non-Gram staining bacillus resembling accurately those obtained in culture from the sputum. Because of the objections of the patient no further cultures from the blood were made.

Many observers have described influenza bacilli in the blood from the earliest time of our knowledge in regard to this organism. In fact, in the same publication which contained Pfeiffer's preliminary communication, Canon[1] claimed to have found the influenza bacillus in the blood in nearly all of 20 cases of acute influenza. These organisms were found microscopically, but were not obtained in cultures. Klein[2] also at this time found the organism in the blood, but much less frequently: only six times among 43 fresh cases. Pfuhl[3] and others also obtained positive results microscopically, and most of the other observations in the literature at this time were demonstrated in this way.

On the other hand, Pfeiffer and Beck[4] took decided exception to this, and claimed never to have found the organism in the blood either microscopically or culturally, though Pfeiffer admits seeing the influenza bacillus twice in microscopic sections and several times growing a few colonies from the spleen and kidney. Not a few observers have found the organism in the blood microscopically, but failed in their attempt to grow it. It is probable that not infrequently dead organisms are present in the blood.

At autopsy the influenza bacillus has been obtained in cultures from the heart's blood by Jehle,[5] Rosenthal,[6] and Doering.[7] Jehle's observations are most interesting and important. His cultures were

[1] Deut. med. Woch., 1892, xviii, 28.
[2] Brit. Med. Jour., 1892, i, 170.
[3] Centralbl. f. Bacteriol., etc., 1892, No. 13, p. 397.
[4] Deut. med. Woch., 1892, No. 21.
[5] Ztschr. f. Heilkunde, 1901, xxii, 3 abth., p. 190.
[6] Thèse, Paris, 1900.
[7] Münch. med, Woch., 1900. xlvii, 1530.

all made at autopsy. The influenza bacillus was most commonly found in the blood of patients dead of the acute exanthematous diseases. The blood of 48 cases of scarlet fever was examined culturally and the bacillus isolated in 22 cases. In 19 cases a pulmonary influenzal infection was present. In 15 of these the blood was positive for the influenza bacillus, while in only 4 cases was it negative. In the other 7 cases in which bacilli were found in the blood no influenzal infection of the respiratory tract could be established, though in three cases these organisms were demonstrated in the parenchyma of the tonsils, and in these cases he regards the tonsils as the probable portal of entry. The bacillus was not always found in the blood in pure culture, as in four cases they were associated with streptococci in varying numbers. In one case, with numerous bacilli in the bronchial secretions, only staphylococci were found in the blood.

Among 23 blood examinations of patients dead of measles the influenza bacillus was found 15 times. In 18 cases the measles was complicated by pulmonary influenza, 9 of which were bronchopneumonia; and in 13 of these the organism was found in the blood. In 2 cases showing influenza bacilli in the blood, no bacilli could be demonstrated in the respiratory tract. One of these cases showed a large number of bacilli in the tonsils.

In 9 cases of varicella with influenzal involvement of the lungs, 5 showed influenza bacilli in the blood. In 24 cases of whooping cough the blood was examined, but in only 2 cases were the bacilli found, though in the bronchial secretions they were obtained in every case in greater or less numbers. Fifteen cases of diptheria were examined, in 9 of which there was an influenzal infection of the respiratory tract. In only one of these cases were influenza bacilli found in the blood. A group of 20 cases suffering from a variety of diseases, but all showing pulmonary influenza, was studied; among these, in only 3 cases could the bacillus be demonstrated in the blood. In one case, which was clinically considered to be a case of pyemia, there came in addition a severe angina, a double pleurisy, and a fibrinous pericarditis. At autopsy great numbers of influenza bacilli were found in the pleural and pericardial exudates, and also a few unidentified diplococci. The two other cases occurred in connection with severe endocarditis. In both cases there was an ulcerative condition of the heart valves. Bacteriologically, in the one, there were very many influenzal bacilli in pure culture, in the other, there were also a great many bacilli, but associated with a few diplococci. Thus, Jehle isolated the influenza bacillus from the blood in 48 cases; 42 of these cases were among the acute exanthematous diseases, while there were only six among other diseases with influenza of the respiratory tract. Especially with scarlet fever and measles, the results would seem to indicate that the bacillus readily finds its way into the blood, and this may happen in the early stages even before

the rash has appeared. On the other hand, among other diseases with respiratory influenza it appears to be not nearly so common.

Thus far we have dealt only with cases in which the influenza bacilli were found in the blood at autopsy or were insufficiently demonstrated during life. Meunier[8] was among the very first to actually demonstrate their presence in the living blood. He reports ten cases of influenzal bronchopneumonia complicating measles, in eight of which cultures were made from the blood and in four instances bacilli in pure cultures were grown, the other four being sterile. The cultures were made from ten days to a few hours before death, all of the four cases proving fatal. In a note he has added one more case of influenzal bronchopneumonia in which he grew the bacillus from the blood, thus making five in all. He does not state whether or not this case resulted fatally. In all of the cases other organisms in varying numbers, such as the staphylococcus, streptococcus, or pneumococcus were found in the pulmonary secretions, although in the majority of them a pulmonary puncture brought forth a pure culture of influenza bacilli, and in others this organism vastly predominated. In these cases of pneumonia he accords to the influenza bacillus the principal role.

Horder[9] reports two cases of influenzal septicemia in which he obtained the bacillus in pure culture from the blood, four times in one case and twice in the other. In one case the cultures were obtained six weeks, and in the other case five weeks before death. Both were cases of malignant endocarditis thought to be engrafted upon an old endocardial lesion associated with previous attacks of inflammatory rheumatism. At autopsy the diagnosis was verified in both cases; the influenza bacillus was the only organism present and they were found in great numbers; and sections showed them deeply situated in the endocardium at the seat of the disease. Horder believed that the infection had taken place through the lungs, although there was no evidence of a definite attack of influenza. In both cases a leukocytosis was present. In one, that of an adult, the highest count was 18,400; in the other, a boy, the highest count was 22,400.

Smith[10] has described a case very similar to the above. The influenza bacillus was grown from the blood in pure culture twenty-seven days before the patient's death. The patient was a man, aged forty-five years, who had a severe attack of influenza eight years previously, and was suspected of having had one or two subsequent attacks. His last illness, which lasted over five months, simulated quite closely enteric fever. There was a bronchitis, an enlarged spleen, quite definite rose spots, loose stools, a leukocyte count of 6300, and an irregular temperature at times reaching 101° to 103°. The Widal test was negative. The autopsy showed a

[8] Arch. gén. de méd., February and March, 1897.
[9] Lancet, 1905, ii, 1473.
[10] Ibid., 1908, i, 1201.

vegetative endocarditis, a pericarditis, and a pleurisy with some effusion, all showing many influenza bacilli.

Spät[11] reports a case beginning as an ordinary attack of influenza, from which the patient recovered sufficiently to attempt to work, but soon was sick again, and after admission to the hospital continued to run a very irregular temperature, the marked rises usually being preceded by a chill, until his death some forty-six days later. The spleen was somewhat enlarged; no rose spots were noted. The leukocytes were 10,600, a loud mitral systolic murmur developed, with some increase in the area of cardiac dulness. Influenza bacilli were grown from the blood ten days before his death. At autopsy there was found a vegetative endocarditis, pleurisy with effusion, and pyonephrosis, from all of which the bacillus was obtained.

Slawyk[12] also has reported a case of general infection with the influenza bacillus, which he grew a few hours before death from the blood, from the cerebrospinal fluid, and from a small abscess on the back of the hand. At autopsy the bacillus was found in the blood, the lung, and in the meningeal exudate.

Brentz and Frye[13] have recorded a case of influenzal infection in a child nearly two years of age, which evidently began as a respiratory infection with bronchopneumonia, and soon became associated with septicemia and meningitis. There was a leukocytosis of 15,600. Influenza bacilli were grown from the blood and from the spinal fluid twenty-four hours before death. The bacilli were also obtained in cultures from the blood and the meningeal exudate at autopsy.

Ghedini[14] seems to have been more successful than any one else in growing the organism from the blood during life, as he obtained it 18 times out of 28 cases. These are described as typical cases of influenzal bronchopneumonia. The cultures were always taken during and in rather the early part of the febrile period. The cases in which the blood proved negative were not so severe a type of the disease. These results correspond very closely with what we find in pneumonia, and suggest that the early observers were more nearly correct than we have supposed.

Thus in all we have been able to collect 30 cases in which the influenza bacillus has been grown from the blood during life. Two complications are to be noted in connection with the case reported, the phlebitis of the right femoral vein and the arthritis of the left wrist. We cannot reasonably doubt that these were specific in origin, the influenza bacillus being present in the blood. Phlebitis with thrombosis we find mentioned not infrequently in the literature in connection with influenza, and Leichtenstern[15] states that it is a relatively frequent occurrence. However, I have found no other

[11] Berl. klin. Woch., 1970, xliv, 1173.
[12] Zeit. f. Hyg., 1898, xxvii, 315.
[13] Woman's Medical Journal, 1908, xviii, 73
[14] Centralbl. f. Bacteriol., etc., 1 abt., Jena, 1906–07, xliii.
[15] Nothnagel's Encyclopedia of Practical Medicine (Am. ed.), Influenza, p. 676.

instance, except the case reported, in which influenza bacilli have been found either in the blood or in the thrombus. As in the case reported, there is usually an increase in the fever, and at times it is accompanied by chills.

A good many cases of influenzal arthritis have been reported, but unfortunately nearly all of them lack a demonstration of the bacillus in culture. Lord[16] states that no special relation has been established between arthritis and influenza. Dudgeon and Adams[17] however, have reported a case in which the influenza bacillus was grown from the pus obtained from the elbow-joint, and after death a pure culture of the same organism was obtained from the pus from the hip-joint. According to Franke[18] these cases of influenzal arthritis for the most part run a favorable course and recover completely.

PATHOGENESIS. There is very little evidence to show that a general infection by the influenza bacillus can be produced experimentally in animals, although Saathoff[19] reports having produced the condition in rabbits to a moderate degree. Pfeiffer, after a long series of experiments on animals was unable to produce a true infection excepting perhaps in apes, in which at least some involvement of the nasal mucous membranes was obtained. As a rule, the symptoms produced were evidently due to the toxins contained in the organisms. Contani[20] believes that the nervous system is especially favorable for the growth of this organism, and he succeeded in producing a well-defined meningitis in rabbits.

The portal of entry of the influenza bacillus into the blood is undoubtedly the lungs in the majority of cases. Usually there has been present some severe infection of the lungs, such as bronchopneumonia. Jehle believes that at least in some of his cases the tonsils were the portal of entry. In a few instances there has been no evidence as to the possible mode of entrance. A primary focus in any part of the body doubtless could afford the opportunity for the organism to invade the blood.

SYMPTOMATOLOGY.—On the whole, the clinical picture of influenzal septicemia resembles that of other forms of septicemia. The symptoms are due to an intoxication, as are those of simple toxemia, which represents the ordinary case. Usually there is profound prostration, lack of appetite, severe headache, and marked general pains. The temperature is usually very irregular, and at times there may be two or more sudden rises, frequently accompanied by a chill, during twenty-four hours. Again, there may be an intermission of more than a day, and a malarial temperature may be more or less simulated. In still other cases the temperature curve may resemble very closely that of the ordinary case of typhoid fever. The onset of complications, as a rule, increases the temperature, which may be accompanied

[16] Osler's Modern Medicine, ii, 482.
[17] Lancet, London, 1907, ii, 684.
[18] Deutsch. Zeit. f. Chir., 1906, lxxxv, 335.
[19] Munch. med. Woch., 1907, liv, 2220.
[20] Zeit. f. Hyg., 1896, xxiii, 265.

by chills. The spleen usually is moderately enlarged and in some cases has been palpable. Quite distinct rose spots are at times present. They were noted in Smith's case, and Monie[21] and others have seen rose spots in connection with the so-called typhoid form of influenza. With ordinary influenza the leukocytes do not exceed 12,000 in 70 per cent. of the cases, and not infrequently they are much lower. On the other hand, the leukocyte count may reach as high as 35,000. In the reported cases of influenzal septicemia the observations are too meagre and insufficient for trustworthy conclusions. Horder's highest count was 22,400; Smith's was 6300; Spät's, 10,600; Bentz' and Frye's, 15,600; and in my case the only count made was 7500. Diarrhœa is present at times, and was noted in Smith case. The urine has not shown important abnormalities except in Spät's case, in which a pyonephrosis was present. Here the urine showed albumin, hyaline and granular casts, and a good many pus cells.

Prognosis. Judging from the cases so far reported, the outlook in this condition is extremely grave. With the exception of Ghedini's cases, which were less severe, all of the collected cases resulted in death with the exception of mine. Possibly further observation will show, as in Ghedini's series, that in the average case the blood is not infrequently invaded, but followed by prompt recovery.

Diagnosis. The diagnosis in these cases must rest entirely upon the demonstration of the bacilli in cultures from the blood; unfortunatly this is not without its difficulties. Ordinary media may be used, as hemoglobin is always supplied. Many now prefer a flask containing about 50 c.c. of bouillon, and into this may be injected about 10 c.c. of the blood to be examined. After incubation at 37° to 38° C. for one to three days, blood agar tubes or plates may be inoculated from this.

Clinically these cases resemble no disease so much, perhaps, as typhoid fever; in fact, the resemblance may be almost complete, showing an enlarged spleen and characteristic rose spots. A blood culture alone will decide the matter. In the literature one finds reports of cases of influenza followed by typhoid fever, such as have been reported by Anders,[22] Da Costa,[23] and others. One cannot doubt that both diseases may occur together, or that typhoid fever may follow influenza, but in the absence of accurate bacteriological examinations of the blood one may be pardoned for suggesting that at least in some of these cases there may have been a general infection by the influenza bacillus. Again, certain obscure forms of fever, such as one meets at times, and especially at periods when influenza is prevalent, may have their explanation in a general influenzal infection. We are much in need of more careful observations on the blood in this disease. Ghedini's observations in regard to the

[21] Bull. Med., Paris, xv, 154.
[22] Medical News, New York, 1896, lxviii, 337.
[23] University Medical Magazine, Philadelphia, February, 1894.

frequency of this bacillus in the blood are quite parallel to what of late years we have been finding in the blood in cases of lobar pneumonia.

TREATMENT. In the treatment of this disease we have as yet no specific. The main hope of the future is that some successful serum will be obtained. Cantani[24] and Latapie[25] have produced serums against this infection, and in some cases these were thought to be of some value in experimental infections, but I am not aware that any serum has been used clinically.

Homologous vaccines should be given a trial when they can be obtained, especially in such cases as those reported by Horder and Smith. Thompson[26] and Barr[27] have recently reported good results with vaccines in several cases of streptococcic endocarditis with septicemia.

In the general management of these cases one may follow the methods in vogue in treating typhoid fever in regard to hygiene, rest in bed, diet, and hydrotherapy, though, as a rule, influenzal patients do not tolerate well the application of cold. Convalescence should be carefully managed. They need especially fresh air and nutritious food. It may take weeks or months before the patient is entirely recovered.

ACUTE PNEUMOCOCCIC MENINGITIS.

WITH THE REPORT OF A CASE SECONDARY TO EMPYEMA OF THE FRONTAL SINUS.

BY E. F. MCCAMPBELL, M.D.,
ASSOCIATE PROFESSOR OF BACTERIOLOGY IN THE OHIO STATE UNIVERSITY,
AND
G. A. ROWLAND, M.D.,
ASSISTANT PHYSICIAN TO THE COLUMBUS STATE HOSPITAL, COLUMBUS, OHIO.

(From the Pathological Laboratory of the Columbus State Hospital, Columbus, Ohio.)

INFLAMMATIONS of the pia-arachnoid due to Micrococcus pneumoniæ are not uncommon. Infections of the meninges with this bacterium are invariably fatal, and consequently the disease is of very great interest. Among 49,028 clinical cases of pneumonia, meningitis occurred in 206, or 0.24 per cent., and at necropsy meningitis was noted in 180 out of 4833 cases of pneumonia, or 3.5 per

[24] Zeit. f. Hyg., xlii, 504.
[25] C. R. Soc. Biol., lv, 1272.
[26] AMER. JOUR. MED. SCI., 1909, cxxxviii, 169.
[27] Lancet, February 23, 1908.

cent.[1] Osler[2] found the pneumococcus in 8 out of 100 necropsies, Aufrech[3] in 7 out of 253 necropsies, and Pearce[4] in 2 out of 121 necropsies on cases of pneumonia. Jundell[5] reports this bacterium in 106 out of 387 cases of acute meningitis. Councilman[6] reports the pneumococcus in 18 out of 61 sporadic cases of meningitis since 1897, and Libman[7] in 6, as secondary infections, out of 100 cases of meningitis.

In regard to the question as to the frequency of primary pneumococcic meningitis, it may be stated that infections of this character are extremely rare. The fact that meningitis so rarely occurs in pneumonia, when in most cases the bacteria are in the blood, gives ample proof of the fact that the microörganisms do not possess any special affinity for the meninges, as is the case with Micrococcus intracellularis meningitidis. Councilman[8] reports a series of 28 cases of meningitis due to the pneumococcus, with the possible primary infection in only 3 cases.

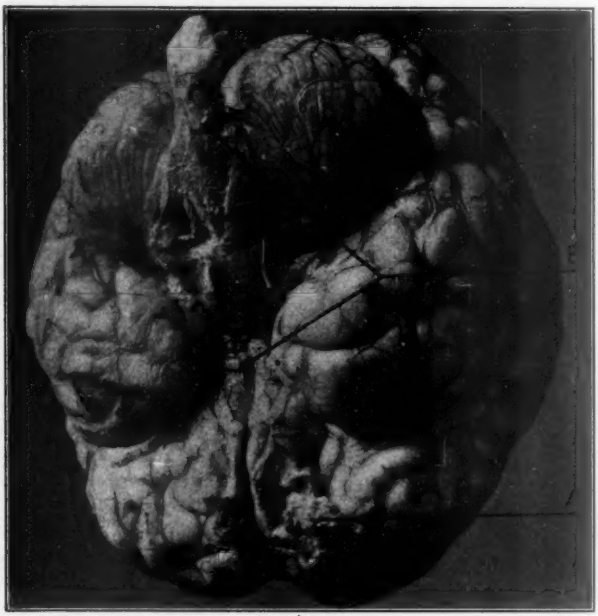
There is a difference of opinion as to whether the pneumococcus may cause epidemics of meningitis. Weichselbaum and Netter both believe that this bacterium may give rise to epidemics, and that it is a very frequent cause of both primary and secondary meningitis. Elser and Huntoon,[9] in their recent exhaustive studies on meningitis, in which they reviewed the work of Schotmüller,[10] do not think that the pneumococcus is capable of inciting an epidemic, and also hold the view that most infections occur secondary to some other pathological process produced in the body by the pneumococcus. It seems probable that those epidemics which have been reported as not being due to Micrococcus intracellularis meningitidis were due to bacteria other than the pneumococcus. In the early studies on meningitis considerable confusion occurred in regard to the differentiation of Micrococcus intracellularis meningiditis, Micrococcus pneumoniæ, Streptococcus pyogenes, Streptococcus mucosus capsulatus, etc., due to inadequate methods.

Pneumococcic meningitis usually occurs secondary to some other infectious process in the body, such as pneumonia, otitis media, mastoiditis, and occasionally in ethmoiditis following natural and operative infections, and in infected wounds following fractures at the base of the skull. In extending to the brain from the ethmoid cells the infection usually passes through the cribriform plate. The case reported by Councilman[11] is typical of this mode of infection.

The case of pneumococcic meningitis which we wish to report

[1] Musser and Norris, Osler, Modern Medicine, ii, 614.
[2] Ibid., ii, 559.
[3] Ibid.
[4] Ibid.
[5] Nordiskt. Med. Arch., 1901, v, 2.
[6] Jour. Amer. Med. Assoc., 1905, xliv, 997.
[7] Mt. Sinai Hospital Reports, 1903, iii, 546. Cited by Elser and Huntoon.
[8] Jour. Amer. Med. Assoc., 1905, xliv, 997.
[9] Jour. Med. Research, 1909, xx, 532.
[10] Münch. med. Woch., 1905, lii, 1617, 1683, 1729.
[11] Loc. cit.

is one which was secondary to an inflammation of the anterior ethmoidal cell and an empyema of the frontal sinus. In this case the frontal sinus extended over the right orbit, the frontal bone was eroded over a small area, and the meninges were infected from this point (see figure). There was no evidence of the infection passing through the cribiform plate of the ethmoid which was the most advantageous point of entrance, as was shown by its relation to the inflammation in the anterior ethmoidal cell. The infection evidently passed to the anterior ethmoidal cell from the nares by way of the infundibulum and thence through the foramen into the frontal sinus.



Acute pneumococcic meningitis. *A*, the point of primary infection over the right orbit; *B*, the area of basilar meningitis surrounded by greenish-yellow pyogenic exudate.

History. F. F., male, aged eighteen years, white, single, box maker, was admitted to Columbus State Hospital, June 4, 1909, with a diagnosis of acute mania by the physicians signing the commitment papers. The present attack began four days previously. He had one previous attack which lasted six weeks according to commitment papers.

Status Præsens. The patient is in a marked delirium. When pressed with questions he answers them incoherently. The body

is well nourished and the musculature good. The pupils are unequally dilated, the right being completely dilated and immobile. The right upper lid shows marked ptosis and the right eyeball is immobile. All reflexes are exaggerated and the skin is hyperesthetic. The lips are surrounded by herpes, and tongue and teeth covered with sordes. The tongue is heavily coated. The patients head is drawn to the right and posteriorly. Attempts to move the head in the opposite direction elicit great pain. The back is rigid and shows a slight opisthotonos. There is slight rigidity in the right shoulder joint. Kernig's sign is present in both legs. The skin is cyanotic over extremities and there is a slight petechial rash over both thighs and legs. The bladder is distended; 900 c.c. of dark amber urine was withdrawn per catheter. The respirations are 22 per minute. The respiratory system is otherwise negative except for a slight dyspnœa and slight vesicular breathing. The area of heart dulness is slightly increased. No murmurs are heard. The rate of the heart is 160 per minute. The skin shows *tache cerebrale* and cyanosis. The abdomen is distended and tender on deep pressure. The digestive and genito-urinary systems are negative.

The patient was taken to the operating room at 4 P.M. and a lumbar puncture made for the diagnosis of cause of the meningitis.

The results of the various analyses are as follows:

Urine. Amber, slightly clouded, specific gravity 1026, acid, albumin 1.5 grams to the liter. Few granular and epithelial casts, few polymorphonuclear leukocytes and erythrocytes, mucous threads. Otherwise negative.

Blood. Erythrocytes, 5,760,000; leukocytes, 33,200. Hemoglobin (Sahli), 100 per cent. Differential: large mononuclears, 2.78 per cent., small mononuclears, 4.4 per cent., polymorphonuclears, 92.8 per cent. Few free nuclei.

Cerebrospinal Fluid. Three c.c. withdrawn, clouded; globulin increased. Large numbers of polymorphonuclear leukocytes. Large numbers of Gram-positive diplococci, free and phagocytized. These microörganisms are typical pneumococci, as was shown by capsules and also later by cultures.

Diagnosis. Acute pneumococcic meningitis.

The usual therapeutic measures for the relief of meningeal inflammation were applied. The patient died at 5 A.M., June 5, having been in the hospital seventeen hours.

The necropsy was performed five hours post mortem and showed the following conditions:

Necropsy Report. Rigor mortis is present. The pleural cavity shows numerous fibrinous adhesions over the upper lobe of the right lung. Both lungs are slightly increased in weight and show slight passive congestion. There is a marked increase in the fluid in the pericardial cavity. The heart is normal. Peritoneum is normal.

The liver is distinctly mottled in appearance and shows marked fatty infiltration together with passive congestion and cloudy swelling. The gall-bladder is normal. The spleen shows a slight passive congestion. The kidneys are enlarged, mottled and lobulated, and the cortex thickened. Microscopic examination reveals acute parenchymatous nephritis. The adrenals are slightly congested. The stomach and intestines are distended with gas and show slight passive congestion. The bladder is distended. The mucosa is slightly congested. The genitals are normal.

A detailed examination of the head and spine reveals the following:

The scalp is of normal thickness and strips easily. There is a slight contusion in right frontal region. The calvarium is normal. The brain weighs 1200 grams. The dura is distended, injected, and the convolutions are barely visible. A large amount of fluid escapes on opening the dura. Cultures and slides show Micrococcus pneumoniæ. The dura is adherent over the orbit in the region of the right frontal sinus. There is an erosion in the frontal bone over the orbit 1.5 cm. to 2 cm., and the opening extends into the sinus. There are marked fibrinous adhesions in this area between the bone, dura, and pia-arachnoid. An inflammatory exudate is also noted. The pia-arachnoid is intensely congested. Fibrinous inflammatory exudate with adhesions is noted along the right olfactory tract to the optic chiasm, back of which the entire base of the brain, including the crura, pons, medulla, etc., are surrounded by the same greenish-yellow, fibrinous exudate. This exudate seems to be limited to the base of the brain, with the exception of the cisterna magna, which contains some exudate, and extends down the cord. The ventricles contain an increased amount of very cloudy fluid. There is a very marked increase in the total cerebrospinal fluid. Pneumococci are very prevalent.

Spinal cord: The dura is adherent to the pia-arachnoid its entire length by means of fibrinous adhesions. The pia-arachnoid is markedly injected. Greenish-yellow, fibrinous exudate is abundant.

Middle ears: normal.

Frontal sinus: The left side is normal, the right side shows an erosion of the frontal bone over the sinus. The right frontal sinus is larger than the left and is filled with inflammatory exudate. It extends well over the right orbit. The mucous membrane is inflamed and necrotic. There is a foramen between the frontal sinus and the anterior ethmoidal cell. This foramen is filled with greenish-yellow exudate. Cultures and slides show Micrococcus pneumoniæ.

Anterior ethmoidal cell: The left is normal, the right shows a slight amount of inflammatory exudate similar to that noted

in the frontal sinus. Cultures and slides show Micrococcus pneumoniæ.

Middle and posterior ethmoidal cells: normal.

Sphenoidal sinus: normal.

Nares: normal.

Anatomical Diagnosis. Acute pneumococcic meningitis, empyema of the right frontal sinus, with slight involvement of the anterior ethmoidal cell, acute parenchymatous nephritis, fatty infiltration of the liver, passive congestion of the lungs, liver, kidney, spleen, intestines, etc., pericardial effusion, cloudy swelling of the liver.

Examination of the tissues from the nervous system and discussion of the pathology of pneumococcic meningitis. The base of the brain shows the most marked lesions. The exudate, which is markedly cellular and fibrinous, extends from the anterior portion of the lower aspect of the right frontal lobe back over the optic chiasm, crura, pons, and medulla down the spinal cord. The exudate is almost entirely confined to the base of the brain and extends deep into the sulci. There is no exudate along the longitudinal fissure. There is an intense injection of all vessels. The meninges of the cerebellum are intensely congested, which is quite characteristic of pneumococcic meningitis. The cranial nerves, particularly the third, show evidences of inflammation. The Gasserian ganglion is swollen. The ventricles show an increase of fluid and a slight amount of exudate. The microscopic examination of the tissues shows the following:

The neuroglia in the subpia is slightly increased. This is characteristic of this form of meningitis, especially in those cases lasting from ten to fifteen days, as is pointed out by Southard and Keene.[12] The cortical tissue is infiltrated with polymorphonuclear leukocytes, and large endothelial phagocytic cells, similar to those described by Councilman,[13] are noted in the region of the blood-vessels. This condition occurs in practically all forms of meningitis. The arteries at the base of the brain show a peculiar infiltration with leukocytes and a pushing up of the intima from the media with the fibrinous exudate. The veins show an infiltration with leukocytes in some places, but no other change in the walls. The cranial nerves and the Gasserian ganglion show a direct extension of the exudative inflammatory process from the brain. The right third nerve shows a slight increase in neuroglia. Changes of this character are said to be most marked in pneumococcic meningitis of long standing.

This case is typical of practically all cases of pneumococcic meningitis. The following points may be noted in regard to this disease: (1) Its virulent and fatal character; 99 per cent. of all cases die. (2) The greenish-yellow character of the exudate, which is markedly

[12] Jour. Amer. Med. Assoc., 1906, xlvi, 13.

[13] Ibid., 1905, xliv, 997.

cellular and fibrinous in constitution. (3) The polymorphonuclear and endothelial cell infiltration of the cortex of the brain. This change is, on the whole, less marked than in the other forms of meningitis. (4) The increase in neuroglia in the subpia and in the cranial nerves. (5) The infiltration of the walls of the arteries with leukocytes and exudate, causing a spreading apart of the intima and media and in addition the infiltration of the veins with leukocytes.

SEROUS MENINGITIS IN TYPHOID FEVER AND ITS TREATMENT BY LUMBAR PUNCTURE.

By Richard Stein, M.D.,
VISITING PHYSICIAN TO THE GERMAN HOSPITAL, NEW YORK.

The object of this communication is to draw attention to a symptom complex occurring in the initial stage or during the course of typhoid fever, called by some by the generic name of typhoid-meningitis, and by others the cerebrospinal type of typhoid fever. German authors designate the condition as meningotyphus. These names, moreover, are intended to include cases of true purulent meningitis caused by Bacillus typhosus, as well as those cases of typhoid fever with meningeal symptoms in which the serous fluid is found sterile after careful bacteriological investigation by culture, etc. They do not include those cases of cerebrospinal inflammations, during the course of typhoid fever, caused by other than the bacterium of Eberth. The term meningeal irritation, or meningism,[1] is generally reserved for those cases in which an anatomical substratum is supposed not to exist. Meningism is a very popular term with French authors. It is nothing more than a very striking clinical phase of certain infectious diseases occurring in the exanthemas, in typhoid fever, pneumonia, etc. Meningism may usher in these diseases, or it may develop during their course. It usually disappears after a short time. If the case ends fatally, a pathological basis for this condition of meningism or meningeal irritation cannot be found at autopsy.

According to Osler, "Cortical meningitis is not to be recognized by any symptom or set of symptoms from a condition which may be produced by the poison of many of the specific fevers." In other words, meningism and meningitis may be clinically identical.

My own observations comprise three cases observed at the German Hospital, in which a serous exudate was found in the subarachnoid space of the cord by means of lumbar puncture. In one case the

[1] This term was introduced by Dupré. Discussion on this subject in the article by Troisier, Bull. et mém. des Hôp. de Paris, xvii, 1900.

evacuation of this spinal fluid saved the patient from imminent death. These three cases, judging from the character of the evacuated fluid belong to the group which has been styled by Quincke meningitis serosa acuta. After the experience which I had made with the above-mentioned case, I was awakened to the importance of meningeal signs in typhoid fever and their effective treatment by spinal puncture. My position is similar to that of Georg Boenninghaus,[2] the author of the monograph on acute serous meningitis, who, in a case of suspected abscess of the brain, of otitic origin, after trephining, saved his patient's life by evacuating serous fluid from the ventricles of the brain by puncture. Brain abscess was not present.

A frank recital of my cases, with special reference to the clinical import of meningeal symptoms in typhoid fever, was at first intended. A review of the literature, however, showed that with the exception of Cole and MacCallum's[3] excellent work, done at the Johns Hopkins Hospital, there exists no comprehensive article on this subject. The treatise of Hare and Beardsly[4] only appeared a short time ago, the last edition being published ten years ago. It was therefore deemed advisable to make a more general study of the subject. I have also been able to add a number of articles, not mentioned by Dr. Cole and Dr. Hare.

The state of our knowledge of typhoid meningitis resolves itself naturally into three different periods: (1) Cases recorded by the old clinicians before the bacteriological era. These include, indiscriminately, cases of typhoid fever with meningitic symptoms, as well as a large variety of cases in which the meningitis arose as a complication brought about by suppurative processes of organs in close proximity with the brain, such as the ear and the frontal sinus. Or, the meningitis was a part symptom of a general sepsis, or finally the typhoid fever and the meningitis partook of the nature of two separate infections. Thus, in two epidemics of cerebrospinal meningitis in Hamburg, Curschmann observed a number of cases of typhoid fever which clinically presented the appearance of the then epidemic cerebrospinal fever. Curschmann suspects that this type of typhoid fever may have been caused by a double infection of typhoid fever and cerebrospinal meningitis.

The second period of our knowledge of this subject begins with the bacteriological investigation of the brain, cord, and meninges. In Curschmann's unique case of ascending (Landry's) paralysis in the course of a case of typhoid fever, that author[5] was enabled to show for the first time the presence of the typhoid bacillus in the

[2] Meningitis Acuta Serosa, 1897.

[3] Johns Hopkins Hospital Reports, 1904, xii, 379.

[4] The Medical Complications and Sequelæ of Typhoid Fever, second edition, September, 1909.

[5] Nothnagel Series, vol. iii, part i, p. 259, and Congress f. innere Medizin, 1886, Band vi, p. 469.

tissue of the cord. That meningitis may occur as a concomitant process during the course of typhoid fever was confirmed by Bernhard[6] who at the same time pointed out the work of Fritz[7] a French physician whose publications on that subject had preceded Curschmann's but had not become generally known. Felix Wolff[8] then published a series of twelve cases from Curschmann's service in the Hamburg General Hospital. A further contribution to the pathology of this subject was then given by Fr. Schulze[9] at Erb's clinic in Heidelberg. He made a careful study of a case of typhoid fever accompanied by severe meningeal symptoms, to which the patient finally succumbed. At autopsy however, certain inflammatory changes were found especially on the vessels of the pia and arachnoid of the cord and brain, the latter organ showing very little, if any change. The fluid in the ventricles of the brain was clear, a purulent meningitis could not be found, nor did the gross appearance or the microscopic examination of the brain or cord explain the fatal ending of this case.

Still a further contribution was that by A. Hoffmann.[10] His case presented clinically all the true characteristic signs of a purulent meningitis in a well-marked case of typhoid fever; opisthotonos, spastic extremities, tremor, coma, and clonic convulsions developed. The patient evidently died from the effects of the cerebrospinal complications. At autopsy the fluid of the ventricles was clear. There was œdema of the pia and arachnoid.

In addition to this was found round-cell infiltration along the vessels of the pia and arachnoid tissues, as well as along the vessels of the cortex. Bacillus typhosus was found in the fluid as well as in the substance of the coverings of the brain and cord. The author looks upon this case as an example of a meningitis directly due to an invasion of the bacillus typhosus into the covering membranes of the brain and spinal cord. He considers the serous exudate of the meninges and the ventricles as the first stage of a suppurative meningitis.

A. Loeb,[11] of Erb's clinic in Heidelberg, describes a case of serous meningitis in typhoid fever accompanied by papillitis and dilatation of the vessels of the retina. The patient showed opisthotonos, coma, increased knee reflexes, and Trousseau's phenomenon. An attempt was made to perform lumbar puncture, but failed; gradual recovery followed. This article is a very extensive literary study, going into all the details of the clinical features of typhoid meningitis. In an article entitled "On Symptoms of Cerebral Pressure in Typhoid Fever," H.

[6] Berl. klin. Woch., 1886, No. 50.
[7] Études cliniques . . . . dans la fiévre typhoid, Paris, 1864.
[8] Deut. Archiv f. klin. Med., Band xliii.
[9] Congress f. innere Medizin, 1897, Band vi, 393.
[10] Deut. med. Woch., July 12, 1900.
[11] Deut. Arch. f. klin. med., Band lxii, 211

Salomon,[12] of von Noorden's clinic in Frankfort, describes a number of cases, which in the initial stage of the fever presented signs of hyperemia in the fundus of the eyes: there was capillary injection in the papilla, the edges looked indistinct, the veins of the retina were dilated and convoluted. Lumbar puncture was made. The liquor cerebrospinalis was sterile and did not agglutinate the typhoid bacillus. The author refers the changes which were found in the fundus of the eye to the pressure exerted by the intra-meningeal exudation. This condition, is, according to him, the direct effect of a serous meningitis.

The third and final stage of our knowledge of this subject begins with the publications of Quincke in 1891, and the universal employment of lumbar puncture in practice. Although this procedure is at present used as one of the routine means of investigation both for diagnostic and therapeutic purposes, we hear very little of its use in connection with the subject under consideration here. This may perhaps be due to the fact that we are inclined to explain the cerebral symptoms occurring in the course of typhoid fever, invariably on the basis of a toxemia, and have neglected to apply lumbar puncture, not expecting to find in the cerebrospinal fluid, in the character of the exudate or transudate, in the bacteriological findings of that fluid, or finally in other still unknown factors, any clue to the cerebral or spinal symptoms by which the disease is characterized.

A comprehensive study of typhoid meningitis with a detailed and tabulated citation of cases from the literature was made by R. I. Cole and W. J. MacCallum. Cole divides the cases into three groups:

Group I. Cases with symptoms of meningitis in which no meningeal lesions were demonstrated or in which no definite relationship between the bacteria and the symptoms are found. This group comes under the heading of meningism.

Group II. Cases showing symptoms of meningitis in which the relationship of Bacillus typhosus was demonstrated by its cultivation from the cerebrospinal fluid during life, or at autopsy, and in which the demonstrated lesions were not of a suppurative character.

Group III. Cases of purulent meningitis (caused by the sole presence of Bacillus typhosus in the exudate).[13]

I am concerned here with the two first groups only, and would say that the term meningism is not identical with the meningotyphus of German authors, as Cole seems to imply. In the German literature typhoid meningitis stands for a clinical type of fever, the pathological basis of which is either a serous or a suppurative inflammation caused by the bacillus of Eberth. Meningism, on the other hand, is reserved for those cases in which a suppurative meningitis is not present, or in which at autopsy the cord and brain show no patho-

[12] Berl. klin. Woch., 1900, No. 6.

[13] The words in parentheses are mine.—R. S.

logical changes. We cannot at present dispense with this term. In looking critically into the French and Italian literature of cases recorded under that name, it will be observed that in many instances lumbar puncture was not done. Furthermore, in the absence of bacteriological investigation and autopsy findings (in the majority of the observations), it is a question, whether these cases were simply examples of meningism or whether they did not rather belong to the group of serous meningitis.

An interesting case of serous meningitis is also reported by Boden[14] of Cologne. A child, aged fourteen years, was admitted to the hospital at the end of the first week of typhoid fever. Hyperesthesia of the body, cyanosis. Two days later, severe epileptic attack, deep stupor, loss of patellar reflex. Left-sided abducens and facial paralysis. Loss of pupillary reflex. Death occurred three days later. Autopsy: Marked typhoid fever. Meningitis serosa. A large amount of clear serum was present at the base of the brain. The brain itself was normal. The ventricles were distended. From the fluid in the ventricles a pure culture of the bacillus of Eberth was obtained. The fluid also gave the Widal test. Two cases of serous meningitis in children with recovery, treated by spinal puncture, are reported by Francis Huber.[15]

According to Quincke's[16] experience in many infectious diseases, such as typhoid and scarlet fever, pneumonia and other unclassified febrile affections, nervous symptoms may predominate to such a degree that the observer is easily led to accept local changes in the central nervous system. On investigation, however, gross pathological changes are not apparent. Lumbar puncture shows an increase of the spinal pressure or of the cellular elements of the spinal fluid. Although serous exudates must not necessarily be caused by the presence of bacteria, we sometimes find in such cases the meningo-, pneumo-, or streptococcus, the typhoid-, coli-, or influenza bacillus. That the bacteria did not as usual lead to a purulent inflammation may be due to their small number or diminished virulence, or to the short duration of the attack. In such cases we must accept the theory that the above mentioned bacteria produce a serous meningitis. The rise in pressure without the bacteria may be accounted for by the clinical irritation of the meninges, which in its turn is due to the toxins of the bacteria. Finally, in those cases in which there is no increase of pressure of the cerebrospinal fluid, we must make the influence of the toxins on the cerebrospinal system accountable for the nervous symptoms.

In the acute serous exudates, Quincke adds, the lumbar puncture has a decided therapeutic effect. "By means of one or two punctures,

[14] Münch. med. Woch., February 28, 1897.
[15] Arch. of Pediatrics, 1894, p. 5.
[16] Deut. med. Woch., 1905, No. 46, p. 1825.

at times a definite decisive turn for the better may be brought about, in the course of an acute affection."

My own cases are as follows:

CASE I.—D. M., a civil engineer, aged twenty-three years, was brought to the private wards of the German Hospital, on October 6, 1907. The previous history of the patient has no bearing on the case. The present history shows that he has been surveying in the northern part of the State, was in the fields all day, and drank water indiscriminately. Status: A well nourished, muscular individual. Has complained of headaches for a week or ten days. Patient is listless. Temperature, 105°; pulse under 100. Patient has diarrhœa, repeated nose-bleed. Physical examination: Coated tongue, abdomen not distended, no rose-spots. Examination of the heart reveals: Moderate distention to the right and left. Loud blowing systolic murmur at the apex. Diffuse bronchitis. Slight dulness on the right chest, posterior inferior. The spleen not palpable. Urine, no albumin. Diazo reaction. Blood examination: Leukopenia, no eosinophiles. Widal suggestive.

Diagnosis. Typhoid fever in the second week. Compensated mitral insufficiency, bronchitis, infiltration of the lower lobe of the right lung. The routine treatment for typhoid fever was applied. Appropriate heart stimulation on indication.

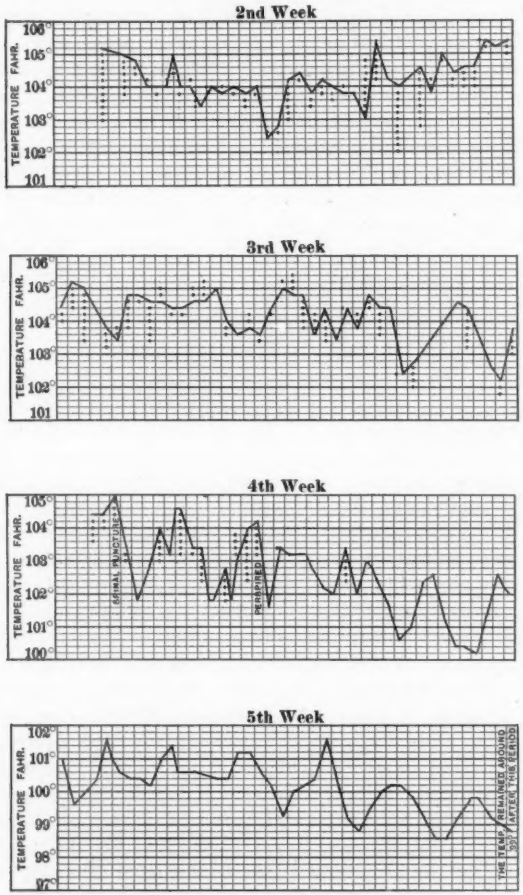
The principal features of the case within the next ten days were as follows:

The patient became more and more drowsy, and had to be awakened when nourishment was given. The cough was very troublesome. Free expectoration. Patient was markedly delirious. The temperature remained pretty steadily around 105°. Remissions under use of the cold sponge and pack. The physical examination now showed that an extended pneumonia of the right lung had developed, with a metapneumonic exudate. The typhoid bacillus was not present in the sputum. The pulse at times distinctly dicrotic. Both respiration and pulse quite irregular at intervals. Toward the end of the third week the cerebrospinal symptoms became more and more marked. The patient lapsed into a deep coma, from which he could hardly be roused. The nights, however, were very restless, the patient at times becoming wildly delirious. He made several attempts to get out of bed. Micturition and defecation involuntary; nausea and vomiting. There developed very marked stiffness of the neck; knee reflexes greatly exaggerated; the patient's upper and lower extremities were held in hyperextension, and showed decided tremor. Foot clonus. Abdomen more and more distended. It became impossible to feed patient. Trismus.

Although the temperature showed some tendency to remission, it reached 105° on the nineteenth day. Both pulse and respirations became very irregular, and the pulse at times was weak and fluttering. The patient's condition seemed very grave; and as the cerebro-

spinal symptoms became more and more marked, lumbar puncture was made, and 40 c.c. of a pefectly clear fluid withdrawn.

The apparent effect on the temperature was very striking, as is shown by the accompanying charts. The patient recovered gradually



The temperature record in Case I, by weeks of the disease.

from his coma. The spinal symptoms also gradually decreased, and disappeared completely within the next few days, and therefore a second puncture was not considered indicated. The effect of the puncture seemed such that the patient lapsed into a

natural sleep. The abdomen became flat, and the patient was again able to take food. Having reached the fourth week of the attack, the remittent stage having already begun, as is shown by the charts, his condition improved from day to day. He perspired very freely. Resolution of his pneumonia had set in at this time. In the fifth week otitis media of the left side developed; somewhat later, periostitis of the left tibia. Both conditions cleared up without further trouble.

The microscopic examination of the spinal fluid showed the absence of cellular elements in the centrifugal specimen. No bacteria in the hanging drop. Cultures tending to prove the presence of the typhoid bacillus were negative. The serum was not tested for the Widal reaction.

CASES II and III.—I have since then observed two other cases in male patients showing symptoms of typhoid meningitis during my summer service of last year. One case was punctured twice, the other case three times. The objective as well as the subjective symptoms of one case completely receded. The patient died later from intestinal hemorrhage. The third case was one of protracted delirium and coma. The physical signs of meningitis were well marked in this case, and these as well as the psychic symptoms seemed to be favorably influenced by this procedure. From 20 to 40 c.c. of a perfectly clear spinal fluid was removed each time. This had no sediment, and cultures were negative. The serum reaction was not made, nor was the spinal pressure determined.

As regards the clinical features of typhoid meningitis, of special interest are those cases of typhoid fever which come under observation with the predominant symptoms of meningitis. In this connection I must mention those remarkable cases, examples of which are reported from time to time, in which the meninges are the sole seat of localization of the typhoid infection without any of the usual lesions of the typhoid process in the intestines or other organs. The first consideration will naturally be that of a precise diagnosis, with all the methods at present at our command. The prognosis and treatment are also determined from the results of this investigation. Cytological, bacteriological, agglutination tests must be carefully made in order to be able to demonstrate, if possible, whether we are dealing with a case of typhoid fever, or cerebrospinal, tubercular, or other variety of meningitis. Secondly, attention should be directed to those cases of undoubted typhoid fever in which meningeal symptoms develop. An exploratory puncture should be made. In some cases the psychic symptoms may be the most prominent; in others, cortical symptoms alone may be present; in still others, cerebrospinal symptoms. The fundus of the eye should be carefully examined; the absence or increase of the knee-jerks, as well as the other reflexes, should be carefully noted. The presence of the Kernig sign or of the ankle clonus may alone give the indication for lumbar puncture. Furthermore,

the determination of the pressure of the spinal fluid by Quincke's apparatus, so painstakingly introduced here by Dr. Henry Heimans,[17] should be carried out in the puncture of these cases.

The small number of cases observed by me does not authorize me to draw any general conclusions as to the strict interpretation of serous meningitis in typhoid fever. Nor would it be scientific to draw broad conclusions as to the etiology or treatment of this symptom complex in typhoid fever, judging by analogous conditions found in other acute infectious diseases. I have the impression that in typhoid fever spinal puncture has not as yet been exploited to the extent that its application seems to warrant. In addition to its value as a diagnostic measure, there remains, I think, the crude indication to remove an excess of spinal fluid in the attempt to mitigate symptoms, which, though they may be due in part to the toxemia, may also be ascribed to an excess of pressure on the brain and spinal cord. Finally, I may perhaps be permitted to quote Keen:[18]

"The symptoms of cerebral involvement in typhoid fever, especially of meningitis, are often overlooked. They are marked by the general stupor, and are supposed to be only connected with the usual delirium of typhoid. I am strongly disposed to think that the meningitis accompanying this disease has been frequently overlooked, by reason of the fact that the head is not very often opened in typhoid necropsies unless the cerebral symptoms have been very prominent. Even in cases without marked cerebral symptoms examination of the brain will show meningitis and infection by the bacilli of typhoid fever to be far more frequent than has been supposed heretofore."

I am indebted to Drs. Garbat, McCready, and Spiegelberg, all of the house-staff of the German Hospital for their hearty coöperation in these observations.

[17] The Technique of Lumbar Puncture, with Special Reference to the Pressure of the Cerebrospinal Fluid, N. Y. Medical Journal, November 17, 1906.

[18] Surgical Complications and Sequelæ of Typhoid Fever, 1898, p. 175.

TUMORS OF THE ACOUSTIC NERVE, THEIR SYMPTOMS AND SURGICAL TREATMENT.

WITH THE REPORT OF A CASE OF COMPLETE RECOVERY AFTER OPERATION BY DR. HARVEY CUSHING.

By M. Allen Starr, M.D., LL.D., Sc.D.,
PROFESSOR OF NEUROLOGY IN THE COLLEGE OF PHYSICIANS AND SURGEONS, COLUMBIA UNIVERSITY, NEW YORK.

Tumors of the cerebellum may be divided into two classes, those involving the hemispheres and the central portion, and those lying upon the base of the brain in the cerebellar pontine angle. While the diagnosis of a tumor within a mass of the cerebellum is not, as a rule, difficult, it is as yet almost impossible to locate exactly the position of such a tumor. Tumors of the acoustic nerve, on the other hand, which occur with about equal frequency with tumors within the cerebellum, are much more readily diagnosticated.

In the early history of brain surgery attempts at removal of tumors in the cerebellum so frequently failed that surgeons became reluctant to undertake this operation. Within the last five years, however, it has been necessary to change this view, and, with the improvement of technique, there have been recorded a large number of successful cases of surgical interference in cerebellar tumors, and more particularly in tumors affecting the acoustic nerve. It seems worth while, therefore, at the present time to present a summary of our knowledge of this subject, to discuss the symptoms and diagnosis of tumors, especially of the acoustic nerve; to collect and analyze cases of operation upon tumors of the cerebellum up to the end of 1909, to discuss their pathology as bearing upon the prognosis of operation, and to describe the technique which has been productive of favorable results. I venture to do this because of my experience in thirteen cases of tumors of the cerebellum, in eleven of which an operation has been undertaken, and because of the fact that I can present a case of perfect recovery ten months after removal of a tumor of the acoustic nerve.

The general symptoms of brain tumor, headache, vertigo, vomiting, and choked disk, which usually appear early in the course of all cerebellar tumors, need no special comment. It is the localizing symptoms which make tumors of the cerebellum, and especially tumors of the acoustic nerve, of particular interest.

Symptoms of Tumors of the Acoustic Nerve. The symptoms which indicate the location of a tumor in the cerebellar pontine angle upon the acoustic nerve may be divided into three classes: (1) Those referable to the cranial nerves; (2) those referable to the involvement of the cerebellar peduncles; and (3) those referable to compression of the tracts passing through the pons.

1. *Symptoms Referable to the Cranial Nerves:*

(*a*) Slight anesthesia of the face on the side of the tumor, first shown by corneal anesthesia and an absence of the corneal reflex.

(*b*) Weakness of the external rectus muscle of the eye on the side of the tumor, due to a pressure on the sixth nerve. This may be first noticed by the occurrence of nystagmus on turning the eyes toward the side of the tumor, and later a decided internal strabismus may occur. The eye looks away from the tumor.

(*c*) A weakness of the muscles of the face on the side of the tumor, first noticeable in a slight disturbance of the act of winking and a slight lack of expression, which is later followed by an actual weakness of all the muscles supplied by the seventh nerve. Pressure on this nerve is rarely, if ever, sufficient, however, to cause a reaction of degeneration in these muscles.

(*d*) Tinnitus in the ear on the side of the tumor, soon followed by some deafness in the ear, which may be slight and only detected by tests with the Galton whistle, high notes or low notes, or both, being lost. This deafness may be as marked for bone conduction as for ear conduction.

(*e*) Vertigo, felt by the patient as a sensation of falling toward one side, or as a sensation of rotary movement of the body, both of which symptoms must be ascribed to irritation of the labyrinthine division of the auditory nerve.[1]

(*f*) Difficulty of swallowing and hoarseness of the voice, owing pressure on the ninth nerve.

(*g*) Sudden attacks, which may be called vagal attacks, referable to irritation of the tenth nerve, consisting of rapid pulse, sensations of flushing of the body or of the head, sudden faintness without an actual loss of consciousness, attended by more or less vertigo.

(*h*) Paralysis of the tongue, shown by thickness of speech or difficulty of articulation, and by protrusion of the tongue toward the side of the tumor.

2. *Symptoms Referable to the Involvement of the Cerebellar Peduncles.* The second set of symptoms is referable to the compression of the cerebellar hemisphere and its peduncles. The portion of the cerebellum that will necessarily be involved is the flocculus, which projects over the middle peduncle of the cerebellum as it comes from the pons. As we have no means of distinguishing between the functions of different portions of the cerebellum,[2] it is uncertain whether the symptoms of a cerebellar nature are due to destruction

[1] I cannot confirm the statement of Stewart and Holmes (Brain, 1904, p. 525), that in cerebellar tumors the sense of displacement of objects in front of the patient is from the side of the lesion to the opposite side. They also state that when a tumor is within the cerebellum the subjective rotation of self is from the side of the lesion toward the healthy side, but when the tumor is outside the cerebellum the subjective rotation is from the healthy side toward the side of the lesion. Oppenheim has also failed to confirm this assertion.

[2] See Horsley and MacNulty, Brain, January, 1910.

of this flocculus or of the two peduncles entering the cerebellum just under the site of the tumor. These symptoms are:

(*a*) A staggering gait and feeling of uncertainty of the position of the body in space when supported upon the legs, which causes swaying when the eyes are closed and staggering when the eyes are open, attended by a disagreeable sense of vertigo, which leads the patient to seek support whenever in a standing posture. The direction of the staggering is, in the majority of instances, away from the tumor, although cases have been put on record in which the patient staggered toward the side of the tumor. The direction of the staggering is not to be taken in itself as a very important symptom, but the fact that the patient staggers *uniformly toward one side* is an important symptom of an affection of the peduncles of the cerebellum as they enter the organ, and therefore the existence of staggering in a definite direction, combined with evidences of the implication of the cranial nerves upon one side, is a definite local sign of a tumor in the cerebellar pontine angle.

(*b*) Another symptom of cerebellar origin is an imperfect muscular tone in the muscles of the arm and leg on the side of the tumor. It is uniformly admitted that the cerebellum has a direct tonic influence upon the muscles, and that this influence is homolateral. This lack of tone is attended by an awkwardness of movement not due to any actual weakness, but to an imperfect coördination of the motions performed. Thus, rapid movements made by both hands or fingers together often prove that the hand on the side of the lesion is moved less freely, rapidly, and skilfully; and other tests may show a true ataxia. There may be also an ataxia of the leg, so that to stand on one foot is impossible. Such an ataxia in the leg may lead to staggering toward the side of the tumor. This symptom has been named diadokokinesis. The maintenance of a proper tone in the muscles appears to have some relation to the response of those muscles to irritation, and it is probably on this account that lesions of the cerebellar peduncles or of the cerebellum are usually attended by a loss of knee-jerk and of the deep reflexes on the side of the lesion; yet this symptom of a loss of reflex on the side of the tumor is not always found in these cases of pontine angular growth. It has been observed, however, in too many cases to allow us to overlook it.

(*c*) Another symptom of importance due to cerebellar lesion is the abnormal position of the head. Whether this is due to a loss of tone in the muscles of the neck which support the head, or whether it is due to the weight of the tumor, producing instinctive drawing of the head downward toward the side of the tumor, or forward or backward, according to the position of the tumor in relation to the axis of the body, may be left uncertain. A reference to Fig. 1, which shows the position of such a tumor inserted in the diagram of Fraser, will indicate that a tumor at this location is very near to

the centre of gravity of the head, and it can be readily imagined that a tumor growing backward might so disturb the equilibrium of the head as to lead to an abnormal position, which might be backward, but would naturally be more toward the side of the tumor than away from it.

3. *Symptoms Referable to Compression of the Tracts Passing Through the Pons.* A third set of symptoms is to be traced to a compression of the motor tracts and sensory tracts passing through the pons and medulla on their way to and from the limbs of the opposite side. Compression of the pons is very much less likely to cause disturbance in the transmission of sensation than in the transmission of motor impulses, and therefore weakness of a hemiplegic type in the arm and the leg in the side opposite to the tumor is more commonly observed than is anesthesia in the corresponding parts. This weakness is usually attended by an exaggeration of the reflex, by an increase in the knee-jerk, ankle clonus, and Babinski reflex, and such exaggeration is doubly evident because of the loss of the knee-jerk upon the side corresponding to the tumor. This weakness of one leg may intensify the difficulty of walking and may influence very markedly the gait. A patient with a weak leg has something of a tendency to stagger toward the leg that is weak, to use it less freely, and to bend downward toward that side. It has already been remarked that many of these patients stagger away from the tumor, and it is not at all impossible that this direction of the staggering is due to the imperfect use of the leg on the side opposite to the tumor. The actual weakness present in the arm or leg may be easily detected by dynamometer tests, and in many cases has amounted to such a marked hemiplegia that any use of the arm or of the leg was impossible. While anesthesia and analgesia in the limbs of the side opposite to the tumor is much less commonly observed than is paralysis, many patients complain of feelings of numbness, tingling, gooseflesh, or burning in these limbs; and such paresthesias may be followed by an actual disturbance of sensation. In the advanced stages of these cases, in which the patients have died of the tumor, a hemiplegia has developed toward the close of life, not, however, involving the face, and it is in these extreme cases that anesthesia has been observed in the paralyzed limbs.

The diagnosis, therefore, of these tumors is easily made from these three sets of symptoms: (1) Of the cranial nerves; (2) of the cerebellum; and (3) of compression of the sensory and motor tracts.

CASES OF ACOUSTIC TUMORS.: In the following case, which was first recorded in 1893,[3] the diagnosis was quite clear:

[3] AMER. JOUR. MED. SCI., April, 1893.

CASE I.—*Tumor of the acoustic nerve; operation; tumor not found; autopsy.* M., aged thirty years, was under my observation from January, 1890, until December, 1891. When first seen he was suffering from severe frontal and occipital headache, from vertigo, which was much increased by moving the head suddenly or while lying down; from tinnitus aurium, from numbness of the left side of the face and in the mouth, and from a very continuous feeling of drowsiness and dulness. These symptoms had developed gradually during the preceding three years, and within a year he had also noticed double vision and a gradually increasing blindness. His friends said that his speech had become "slow and thick."

He was referred to me by Dr. Weeks, from the Eye Department at the Vanderbilt Clinic, where an examination had shown great prominence of the eyeballs, the left one deviating outward; dilated pupils; marked nystagmus on lateral movements of the eyes; well-marked choked disks; and diminution of all visual fields.

My examination showed that there was some slowness of speech, which was accounted for by his mental dulness, there being no evidence either of aphasia or of paralysis of the tongue. There was no disturbance of sensation, of motion, or of reflex action, and there was no ataxia in the gait. The existence of headache, vertigo, tinnitus, nystagmus, diplopia, and choked disks established the diagnosis of a cerebral tumor, but no conclusion could at first be reached with regard to its location. During the year 1890, however, other symptoms developed which aided in the localization. The patient gradually became deaf in the left ear; he began to stagger in walking with a tendency to fall forward and toward the right, and a very marked tendency to turn toward the right in walking along a straight line. In addition, there developed a weakness in the right hand and exaggeration of the knee-jerk on the right side, with slight clonus in the right foot. There was no ataxia or disturbance of sensation in the limbs. The staggering was that of a drunken man, without falling, but with every appearance that the balance was quite uncertain, and the tendency to turn and fall to the right was quite constant and noticed at every examination. The pain and numbness in the left half of the face continued occasionally during the year, but there was never at any time any anesthesia. The tinnitus in the left ear disappeared gradually and the deafness in the ear increased. The headache, which at first had been frontal, was later referred more and more constantly to the left occipital region, and in speaking of it he habitually put his hand back of his ear.

A thorough course of specific treatment was carried out during the years 1890 and 1891 without any results. Toward the close of 1891 his condition had become one of complete helplessness and total blindness. The staggering was so exaggerated that he could not walk about without the help of two persons, and he was finally induced to enter Roosevelt Hospital in December, 1891, for an

operation. This operation was done by Dr. McBurney on December 3, 1891. The left half of the occipital bone was exposed by a tongue-shaped flap. The bone was removed by chisel and mallet, an opening about an inch and a half in diameter and triangular in shape being made through the occipital bone. The dura bulged strongly through this opening, indicating great increase of intracranial pressure. When the dura was divided the cerebellar tissue protruded, and it was necessary, in order to go on with the operation, to cut off quite an amount of cerebellar substance in order to palpate the parts below. The finger was introduced along the various accessible surfaces of the cerebellum, but nowhere was it possible to reach the tumor. Hemorrhage was only moderate, and easily controlled by pressure. The flaps of the dura were united, the overlying soft parts replaced and fastened with catgut sutures, the skin wound being sewed with silk.

Convalescence was perfectly satisfactory from the immediate operation, and six days after the operation, normal temperature having been maintained throughout, primary union was found throughout the whole extent of the wound, and all sutures were removed. The patient, therefore, had recovered from the operation, but the operation had been of no service. There was every reason to believe that he would have remained in the condition in which he was before the operation, but unfortunately, on the seventh day he fell out of bed, and soon after died from a hemorrhage which had occurred, as a result of this fall, under the skin flap.

At the autopsy a gliosarcoma, quite distinctly limited, from the cerebellar and adjacent tissue, was found lying on the base and compressing the left hemsiphere of the cerebellum on its anterior inferior surface, pressing upon the left half of the pons and compressing the seventh and eighth nerves.

This I believe to have been the first attempt of the surgeon to remove a tumor from this cerebellar pontine angle, and the lesson to be drawn from the operation was that by a unilateral opening through the occipital bone it was almost impossible to reach the tumor. Reference to Fig. 1 will show that a great portion of the cerebellum lies between the bone at this location and the tumor. In spite of this difficulty, another attempt was made by Dr. McBurney, on March 12, 1893, to remove a similar tumor, and with success. The history of this case is as follows:[4]

Case II.—*Tumor of the acoustic nerve; operation; tumor removed; death.* W. W., aged ten years, began to suffer, in October, 1892, from frontal headaches, worse at night; then from an occasional vertigo and attacks of intense headache, associated with vomiting, and occurring every third or fourth night. During December he became rather dull mentally and very irritable, and

[4] Reported in Brain Surgery, Case XXIV, p. 247, Wm. Wood & Co., 1893.

then the symptom of staggering was first noticed. During January, 1893, he was examined by Dr. Kipp, of Newark, who found a well-marked condition of optic neuritis, and then for the first time he

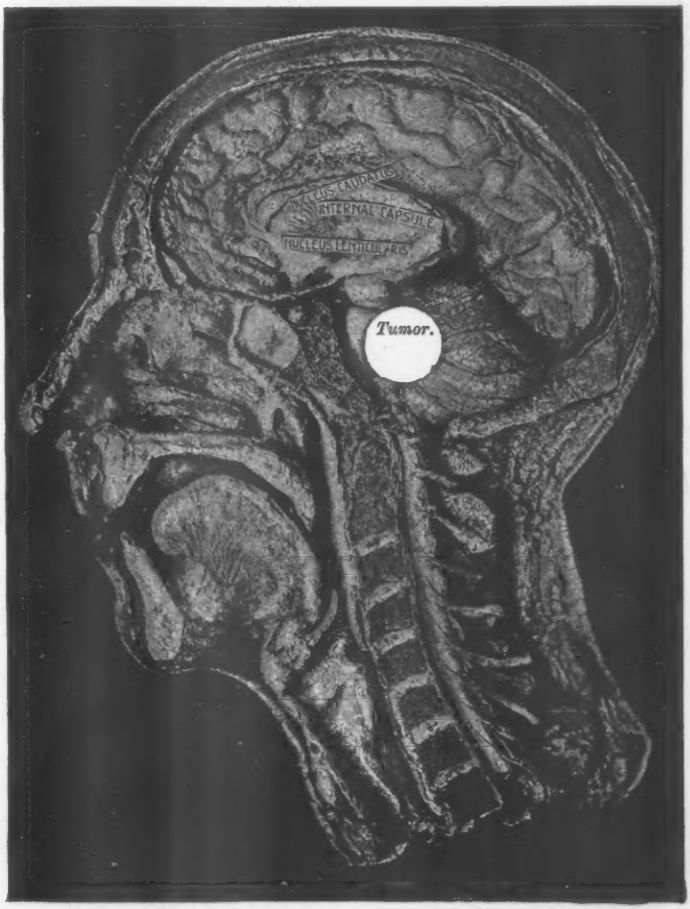


FIG. 1.—Fraser's photograph of a sagittal section of the head, showing the situation of the acoustic tumor in Cases II and VI.

noticed some dimness of vision. At that time he was still able to read large print without much difficulty, but by February 1 he had become almost totally blind. During February the headaches, usually nocturnal, increased in severity, were always associated

with vertigo and vomiting, and he began to have ringing in the left ear and deafness in the right ear. His gait was noticed to be very unsteady, his eyes were prominent and in constant oscillation, and his mental dulness was intense.

He was referred to me by Dr. William Pierson, of Orange, N. J., on March 12, 1893, with the preceding history.

Examination showed a fairly nourished but pale little boy, with a large head, prominent forehead, protruding eyes that were blind and in constant lateral oscillation. At rest, there was a manifest tendency of the right eye to turn inward, but he could look in either direction without apparent paralysis of the ocular muscles. All ocular movements were attended by marked nystagmus. Very extensive optic neuritis was found in both eyes, and he was blind. Smell was lost in the left nostril. There was no apparent paralysis or anesthesia in any part of the body or face, but a slight facial paresis on the right side was noticeable, and he was unable to whistle on account of inability to close the right half of the mouth. His hearing was decidedly defective in the right ear. His reflexes were diminished in both knees. His gait was distinctly a staggering gait, with a very marked tendency to stagger toward the left side. In groping his way forward he would tend to turn toward the left side. He described his headaches as being agonizing, and referred them entirely to the frontal region. The skull was tender to percussion over the vertex. The headache was very much increased by a recumbent posture, so that for many nights he had sat up all night.

The diagnosis of a tumor in the cerebellar pontine angle was reached by the symptoms of cerebellar gait, with a tendency to stagger to the left side, by the deafness in the right ear, and slight weakness of the right side of the face and of the right external rectus muscle, and an operation was therefore recommended.

On March 15, 1893, Dr. McBurney exposed the occipital bone on the right side, chiselling it away and enlarging the opening so far as possible in all directions by a rongeur. On dividing the dura, which bulged tremendously, a cyst, containing a dram of yellowish-green fluid, was exposed and evacuated. When the cerebellum was crowded over toward the median line beneath this cyst wall, a tumor was felt. The portion of the cerebellum which had bulged into the wound was then sliced off in order to give access to this tumor. It was gradually enucleated by the aid of a finger and a spoon. It contained one or two small cysts, which ruptured in the process of its extraction. It was gradually removed, being shelled out from the cavity in the cerebellum; it had no distinct capsule. Clean cerebellar tissue was left around the previous site of the tumor. Hemorrhage was arrested by compression and by packing the wound, and a drain was left in the wound, and the dura and scalp were closed.

The boy recovered from the shock of the operation, but gradually grew weaker, and after about two weeks died in the hospital. This was, I believe, the first successful case of removal of a tumor from this locality.

The record of operations upon the cerebellum up to the close of 1893[5] showed that 15 cases had been operated upon, and that in one only had successful removal of the tumor, with recovery of the patient, been recorded. Discouraged by this record, for a number of years I refused to recommend operation in cases of cerebellar tumor.

The next case I will not give fully. It was one in which the autopsy showed a cyst of the cerebellar pontine angle. The most prominent symptom was a mental deterioration and progressive dementia. No diagnosis of the location was made.

CASE III.—*Cyst of the cerebellar pontine angle; no diagnosis; autopsy.* Female, aged fifty-three years, began to suffer in October, 1895, rather suddenly, from a numbness of the entire left side of the body and marked unsteadiness in gait. Soon after she noticed that the leg felt heavy in walking, so that she thought she dragged it, but as a matter of fact she used all the muscles freely. During this time the motions of her left hand became awkward, and it was found that she frequently let things fall out of her hand. During the winter of 1896 these symptoms continued and increased, and it was noticed that she was becoming progressively more and more dull mentally, as shown by her lack of interest in things about her when sitting idle, when formerly she had been an active woman, and by her becoming unable to play whist.

When seen on January 24, 1896, in consultation with Dr. Adler, her optic disks were found to be normal; fields of vision normal; ocular movements normal, but attended by a nystagmus on turning the eyes to either side. There was a flatness of the left side of the face, the left eye not winking normally with the other, but it was possible to close the eye, and voluntary movements of the lips and cheek were perfect. There was no paralysis of the left arm or leg, motions of resistance in all directions and in all muscles being perfect and reflexes normal, but there was a marked ataxia of both left arm and hand and of the left leg. The hand was held in an awkward position. Her sense of position of the hand in space and of the position of the fingers was imperfect, but sensations of touch, temperature, and pain were normal and equal on both sides. She had complained of a good deal of pain over the left ear and behind the left ear, but she had no deafness, no vertigo, no vomiting. The case, therefore, at this time seemed to be quite obscure, and no diagnosis was possible. She was subject to uterine hemorrhages, and was exceedingly anemic, and for this condition she was treated

[5] Brain Surgery, p. 249.

during the year of 1896, but during that year she became progressively worse, the feebleness of the left side and awkwardness steadily increased, so that by October, 1896, she was unable to walk without help, and in November, 1896, she was confined to her bed. The ataxia of the arm had also increased during this time, so that the arm was practically useless for finger movements; she could no longer feed herself or adjust her hair. The facial paralysis on the left side had also increased.

When seen again, on January 17, 1897, in consultation with Dr. Polk and Dr. Knapp, the facial paralysis was quite complete, of the peripheral type. The power in the left arm and left leg was almost normal, but the ataxia in both limbs was very pronounced. Motions of the eyes produced nystagmus, and it seemed impossible for her to turn her eyes conjugately toward the left, but there was no strabismus. During the year of 1896 her mind had become progressively impaired, so that in January, 1897, she was almost in a condition of stupor. It was with great difficulty that she answered any question. She did not seem to pay attention to questions or to requests until they had been repeated over and over, but then, when they finally appeared to reach her consciousness, she would answer or act appropriately. She could not balance herself in a sitting posture in bed; she had been totally incapable of standing on her feet for a month of more, and if held up in the bed her head fell backward, and a great deal of pressure backward was made of the entire body. This tendency to fall backward had been noticed by others for several weeks. For the last two months there had been an absolute lack of control of the sphincters, and she had paid no attention to the wants of nature. This was ascribed to the obscure mental condition. The optic disks, examined by Dr. Herman Knapp, were found to be normal. There was apparently no deafness, no anesthesia, no blindness. She did not suffer from headache, vertigo, or vomiting; she was fairly nourished.

During the month of January she lay in the same condition of stuporous indifference to her surroundings, never roused up of her own accord, or spoke, though if sharply questioned, after a considerable length of time would reply accurately. In addition to the facial paralysis of the left side, there had developed by February 1 an anesthesia of the left cornea and slight tactile anesthesia of the left side of the face. The tendon reflexes of the left side had become much exaggerated, the ataxia remained, but no paralysis had appeared. During the month of February she grew progressively more feeble, an infection of the bladder occurred, and on March 2 she died.

The autopsy showed the existence of a cystic tumor lying on the left side of the pons, at the position of its junction with the medulla and the cerebellum, all of which organs were deeply indented by the tumor The tumor measured 5.5 cm. in an anteroposterior

direction, 4.5 cm. laterally, and 2 cm. vertically. It was a cyst filled with fluid of a whitish color, in the walls of which irregular thickenings of fibrous nature were seen. The tumor was not adherent anywhere to the brain, but it was adherent to the dura just behind the ridge of the petrous portion of the temporal bone. The seventh and eighth nerves ran in the wall of the tumor, and were torn off from the brain in removing it. The sixth nerve had been compressed by the anterior edge of the tumor. The pressure of the tumor had indented the pons deeply upon its side, but had not compressed the pyramidal tracts of the medulla. The pressure on the medulla had been exerted upon the olivary body and restiform body, which were compressed backward. The cerebellum was deeply indented in its middle peduncle, so that when the tumor was removed a deep indentation in the middle peduncle of the cerebellum was visible. The ventricles of the brain contained a considerable amount of clear serum, and were distended more in the posterior horns than in the anterior, but this distention was not very marked. The brain did not appear to be very much compressed, the convolutions were not markedly softened, and the dura was not very tense. There were no changes in the pia and no hemorrhages within or upon the brain. The cerebral hemispheres were normal.

In reviewing the history of this case, which was throughout its clinical course most obscure, and in which the only general diagnosis was one of brain tumor without any definite localization, it is evident that the pressure upon the seventh nerve was the first symptom, together with the ataxia of the limbs on the side of the tumor, with a tendency to fall in walking, to stagger, and to fall backward. As the tumor advanced, the left sixth and fifth nerves were involved, but it is rather surprising, in consideration of the fact that the tumor involved the acoustic nerve, that there were no symptoms of deafness or of vertigo, and in view of the size of the tumor, it is quite surprising that there were no symptoms of optic neuritis. The mental condition was really the most noticeable of all the symptoms present.

While mental symptoms occur in between 50 and 60 per cent. of all cases of brain tumor, as shown by the careful analysis made by Schuster,[6] yet it has been noticed that in tumors of the cerebellum such mental symptoms are only present in about 25 per cent. of the cases. As a rule, they consist of a progressive stuporous condition, with dementia; rarely hallucinations occur; usually there is a condition of progressive inability to use the mind. I have elsewhere pointed out the frequency of this symptom in connection with tumors of the corpus callosum and of the frontal lobes.[7] But the

[6] Psychische Störungen bei Gehirn Tumoren, Stuttgart, 1902.

[7] AMER. JOUR. MED. SCI., 1895, "Tumor of the Corpus Callosum, with Autopsy," by Francis and Starr.

case here put on record is the only case of tumor of the cerebellum which I have seen in which such mental symptoms appeared. Ballance[8] states that the mental state is normal, or only affected late, as a consecutive phenomenon. Glasow,[9] in recording a case of cerebellar tumor, has noticed such mental symptoms, but the rarity with which these symptoms are recorded in the large number of cases of cerebellar tumor which I have been able to gather convinces me that the percentage given by Schuster is excessive, and than in not more than 10 per cent. of cerebellar tumors are mental symptoms observed in the early stages. It is, of course, true that in the later stage of the disease, when the ventricles are distended by fluid and the general intracranial pressure is much increased, under which circumstances the patients are likely to be blind, a demented state may develop, but as an early symptom of tumor of the cerebellum, I believe mental disturbances are most unusual.

In 1903 the following case was seen at the clinic, and was sent to the Presbyterian Hospital for the purpose of an attempt at removal of the tumor.[10]

CASE IV.—*Tumor of the acoustic nerve; sudden death.* F. K., aged seventeen years, when seen at the clinic, had all the symptoms of brain tumor, which had lasted about a year, developing gradually. She had severe headaches, worse in the morning on awakening; attacks of vomiting; intense vertigo, and double choked disk, which was gradually impairing her eyesight. She had also a typical cerebellar ataxia, staggered in walking, found it difficult to maintain her balance, and had a marked tendency to stagger toward the right side.

Examination showed a slight weakness of the left external rectus muscle, flattening of the left side of the face without any actual paresis, and marked deafness in the left ear. While there was no paresis of the limbs of the right side, the reflexes on that side were markedly exaggerated. She had had many attacks of sudden faintness with vertigo and a sensation of alarm, which were interpreted as vagal attacks. She had become somewhat dull mentally, but was intelligent enough to give satisfactory answers to all questions, and presented no other symptoms than those here described.

It seemed probable from these symptoms that the tumor lay upon the base of the brain, involving the cerebellum, the sixth, seventh, and eighth cranial nerves, and with this diagnosis in view, Dr. McCosh agreed to operate and attempt to remove the tumor. While the patient was being examined by the house surgeon, on the day prior to the date fixed for operation, she suddenly fell back in bed, became cyanotic, and ceased to breathe. Artificial respiration was immediately begun, and so long as it was kept up the cyanosis

[8] Some Points on the Surgery of the Brain, p. 232, Macmillan Co., 1907.
[9] Archiv f. Psychiatrie, xlv, 310, Berlin, "Zur Kasuistik der Gehirn Geschwülste."
[10] See Brain Surgery, p. 253.

was relieved, her pulse beating normally though rapidly. She was, however, completely unconscious. Artificial respiration was kept up in this manner for eight hours, all possible means of resuscitation were tried, but no natural respiration appeared to be possible, and although her heart continued to beat after respiration was suspended, it seemed impossible to prolong her life, and at the end of eight hours she died.

No autopsy was permitted in this case, but recent investigations have shown that the cause of death in such cases is the pressure of the tumor above forcing cerebellar tissue downward into the foramen magnum and thus compressing the respiratory centre.[11] It seems reasonable to suppose that this occurred in this patient. The condition found in the case soon to be described (Case VI) warrants this supposition.

Bernhardt[12] called attention to the greater frequency of sudden death in cases of tumor of the cerebellum than in tumors elsewhere in the brain, his statistics showing the ratio as 24 per cent. to 7 per cent.; and both Oppenheim and Bruns confirm this observation. Horsley[13] recorded 3 cases of sudden death in his record of 95 cases of brain tumor. Tietze[14] reported a sudden death after lumbar puncture, and Cushing[15] has called particular attention to the risk of lumbar puncture in cases of cerebellar tumor, and has recorded two fatal cases and one case in which life was saved by prompt operation after respiration had ceased.

In the following case the diagnosis of a cerebellar tumor was comparatively easy, but the result of the operation was not favorable:

Case V.—*Glioma of the cerebellum, invading the pons; operation; death.* L. B., aged seven years, was sent to me by Dr. Francis, of Montclair, on September 30, 1904. Her symptoms had gradually developed during two years prior to this time, following a blow upon the head on the left side in the parietal region, where there existed a marked thickening of the bone. Headache, vomiting, and optic neuritis had developed slowly, with a progressive diminution of her mental development, and after a year of these symptoms ataxia in her gait was noticed, together with an awkwardness of the arms, most marked upon the right side. The ataxia of gait increased steadily during the second year, so that when she was examined it was very difficult for her to walk, and in consequence of the inactivity of the right side, there was a marked atrophy of both arm and leg, considerable weakness in them, and a slight disturbance of sensation felt as a numbness.

[11] For a photograph of this condition see Turner and Stewart, Text-book of Nervous Diseases, p. 236.

[12] Beiträge zur Diagnostik der Herngeschülste, Berlin, 1881.

[13] Brit. Med. Jour., August 23, 1906.

[14] Berlin. klin. Wochenschr., May 18, 1908.

[15] Interstate Med. Jour., September, 1909.

During the year prior to the date of examination she had had four attacks of stupor, each lasting several days. They were usually preceded by vomiting and attended by high temperature, and on each occasion the child's life was despaired of, as it was impossible to feed her, and the bladder and rectum were not under control. After each of these attacks, however, she gradually recovered consciousness, and seemed a little better after each attack than she had been before it.

When examined, she was found to have double choked disks and to be almost completely blind. She had exophthalmos of the right eyeball and paralysis of the right external rectus muscle. She had a flattening of the right side of the face, a loss of corneal reflex, slight anesthesia of the right side of the face, and some deafness in the right ear. She could not sit up or hold her head up, and when held up it tended to fall forward. She had a very marked ataxia of the right hand and of the right leg, some ataxia also in the left hand. No absolute paralysis in any muscle. No history of convulsions, of vertigo, of insomnia, of change of pulse. A course of mercury and iodide of potassium had been carried out with marked improvement for a few months, but was followed by a relapse.

The diagnosis in this case was a tumor in the right half of the cerebellum on the base, compressing the sixth, seventh, and eighth cranial nerves on the right side, and producing the ataxia of the right limbs due to injury of the cerebellum on the right side; and an operation was at once recommended. This operation was done by Dr. McCosh on November 15, 1904, at the Presbyterian Hospital. The occipital bone was exposed over the right side, but when the periosteum was stripped back venous hemorrhage occurred in an alarming condition from the bone, which appeared to be soft and porous, and which was controlled only by packing and pressure. This packing was removed on the second day, but the bleeding recurred, so that further opening of the skull was not deemed possible. At this time a tube of radium was inserted into the wound and left in for half an hour, and following this each day for five days the back of the head was exposed to the *x*-rays for ten minutes.

The child was then sent home, as an operation was thought to be impossible, but as the symptoms, which had at first been relieved, possibly by the bleeding, recurred, and as her condition was very serious, a second operation was undertaken on December 31.

The cerebellum was exposed, and on this occasion bleeding was not severe. Exploration with the finger and with a needle failed to expose the tumor, probably on account of lack of room, the exposure having been unilateral only. The wound was then enlarged upward, the tip of the occipital lobe was exposed, a needle was introduced into the posterior horn of the lateral ventricle, a large amount of fluid was evacuated from the ventricle, and horse-

hair drains were introduced through the aspirating needle and the needle was withdrawn, thus draining the lateral ventricle. During the following three weeks this drainage was kept up; at times as much as 20 ounces of cerebrospinal fluid drained into the wound. The evacuation of the ventricular effusion was attended by very marked relief, the child became bright and active mentally, the headache disappeared, and the congestion of the veins in the retina was considerably relieved, although her sight was not improved. At the end of that time, however, the child died.

The autopsy revealed the existence of a sarcoma, occupying the right lobe of the cerebellum, infiltrating this lobe, and reaching the base upon the right side, where it had pushed the medulla over toward the left side. A small projection of the tumor ran forward upon the pons Varolii and compressed the sixth, seventh, and eighth nerves at this point. The tumor also infiltrated the middle lobe of the cerebellum, so that it lay upon and compressed the floor of the fourth ventricle. It had no capsule, and it would have been very difficult to have removed it, had it been revealed at the operation, without removal of the hemisphere of the cerebellum. The ventricles were enormously distended, and contained 455 c.c. of serum.

In this case, even had a larger exposure of the cerebellum been made, it is evident that the operation would not have been successful, on account of the infiltrating character of the tumor. The futility of *x*-ray and of radium treatment in a glioma is demonstrated by the result of this case.

The last case to be recorded had, however, a much more favorable result.

Case VI.—*Tumor of the cerebellar pontine angle successfully removed, with perfect recovery of the patient.* Female, aged forty years, was referred to me in October, 1908, by Dr. Synnott, of Montclair, N. J., and Dr. Broughton, of New York, with a history of gradually advancing brain tumor. She dated her symptoms from May, 1908, but there is reason to believe that they began much farther back in her history. Occasional sensations of vertigo had been felt at intervals since 1902. A severe attack of pain in the left suboccipital region lasting two weeks, which made riding in a carriage or jolting unbearable, had occurred in 1905, but had not recurred. While pregnant, in November, 1907, she suffered much from ringing in the left ear, and noises like the sound of a sea shell or the escape of steam; also from sudden faint feelings in the stomach. She miscarried in December, 1907, and then these symptoms ceased. From May, 1908, she had been suffering from headaches, especially severe in the morning on awakening, or on awakening from sleep if she slept in the daytime, headaches that were very markedly relieved by taking food, and that seemed to have had no definite location, but to have been felt all over the head,

sometimes in front, sometimes at the back, and in the eyes. During the summer this headache was attended by a certain amount of deafness in the left ear and a slight flattening of the left side of the face, and with weakness of the orbicularis palpebrarum, so that in the act of winking it was noticed that she winked less forcibly with the left eye. During the summer considerable awkwardness of gait gradually developed, with a marked tendency to stagger in walking, and a feeling of falling, and by October this cerebellar staggering was very marked, so that she had to be supported in walking. During August she began to notice some disturbance of her eyesight, and it was this that led, in October, to her consulting Dr. Broughton, who discovered a double optic neuritis, a marked lateral nystagmus on motion to both sides, and a very marked prominence of both her eyeballs, with tendency of the eyeballs to diverge at rest. She had at that time no hemianesthesia and no paresis of the limbs, but the knee-jerks were markedly exaggerated.

The diagnosis was made of a tumor in the auditory region on the base, and the suggestion was made that she be treated with mercury and iodide of potassium, although there was no history of specific disease. Improvement in the symptoms began soon after this treatment was commenced, and for two months, November and December, she was practically free from her headache and her deafness was less marked, and her eyesight did not grow worse. In January, however, she began to suffer again from the same symptoms, gradually grew worse during February, and when I saw her on March 27, 1909, all her symptoms were more pronounced than at the first examination. Her headaches were very intense, so much so as to incapacitate her from all effort. They were worse at night and very much worse on awaking from sleep. She had vomited occasionally when the headache was very intense. They were still relieved by taking food, and she appeared to have an abnormal appetite, for she had gotten into the habit of taking food every two hours, which she seemed to digest well. But in spite of this, she had lost weight, she looked thin, and had the appearance of a person who was ill and in suffering. Her optic disks were much more swollen than they had been in October, her vision was reduced to $\frac{2}{7}\frac{0}{0}$ in each eye, and there was a marked diminution of the visual field for colors. Vertigo was a constant symptom, but it did not appear to be a vertigo in any particular direction. The deafness in the left ear had increased so that a watch was no longer heard at the ear, and bone conduction was markedly diminished to the tuning-fork. Nystagmus was very evident on any motion of the eyes, but was distinctly worse when the eyes were turned to the left. Deviation of the eyes outward was still noticed, and a very marked exophthalmos, a little more marked in the left eye than in the right. The weakness of the left side of the face was pronounced, winking being imperfect, and a

forcible closure of the left eye being impossible. Her knee-jerks were both exaggerated equally. She had begun to have some tingling and numbness in the left leg. In walking, she staggered more than she had before, and her staggering was now distinctly toward the right side. This was not due to any weakness of the right leg, which, on being tested, was found to be as strong as the other. She felt as if she were falling toward the right side when standing, and she swayed more toward the right side with her eyes closed.

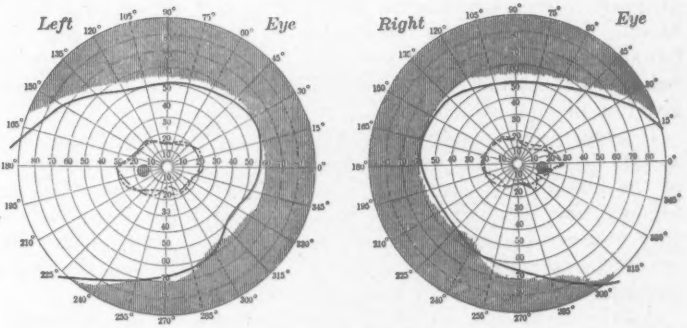


FIG. 2.—The visual fields prior to operation, showing contraction of the color fields, and interlacing of blue and red fields, with marked inversion of the fields. (Dr. Bordley.) (. . . . . red; —.—.—.— blue.)

The failure of the constitutional treatment to have any effect in relieving her permanently led me to advise an operation, and knowing the success which Dr. Harvey Cushing, of Johns Hopkins, Baltimore, had had in such cases, I suggested that she go to him for operation. After some delay this was agreed upon, and she went to Baltimore on May 14.

Examination in Baltimore at that time confirmed the existence of the symptoms here recorded, and, in addition, very careful perimetric measurements of the visual fields were made, which are here given. These showed a diminution of the visual fields of color, with an interlacing of the red and blue fields, as shown in the diagram, a condition which Drs. Bordley and Cushing have pointed out as a valuable symptom of brain tumor. The swelling of the optic disks was 5 D. At that time, before the operation, she was also suffering from numbness in the leg, arm, and face on the left side. She had a great deal of ringing in her left ear, associated with the deafness; she had marked double vision; she had a sensation of falling, especially toward the right side, and it was found that on lying on her back or on either side in bed, or on changing her position in bed, the sensation of vertigo was very markedly increased.

She could not lie at all on her left side. It was also discovered that in rapid motions of the hands some awkwardness was apparent in the left hand. This did not amount to any disability, as she could feed herself and fix her hair perfectly, but on simultaneous rapid motions of the fingers and wrist it was evident that the left hand presented a certain degree of incoördination. The staggering toward the right was particularly noticed. In obtaining her history Dr. Cushing elicited the fact that for a number of years she had been somewhat unsteady on her feet in certain movements. Thus, as far back as 1900 she had noticed in playing golf that she felt very unsteady when addressing the ball in sending it off, and that it had become practically impossible for her, in 1905–06 to play golf with her accustomed facility, because of the difficulty in maintaining her balance and hitting the ball accurately, so that in 1906 she had given up playing golf entirely.

It seems probable, therefore, that the symptoms had begun with a slight degree of imperfect balance eight years before the occurrence of the headache, which was considered the first symptom of the tumor, a fact which indicates that in all cases of brain tumor it is wise to ascertain whether little unusual manifestations of activity, sensation, speech, or conduct may not have preceded the active development of the symptoms by some years.

Another symptom elicited by Dr. Cushing was the occurrence occasionally during the two years prior to the development of the headache of peculiar attacks, known as vagal attacks—a sudden sensation of alarm and faintness without an actual faint, attended by palpitation of the heart and probably by a very rapid pulse—an indication of irritation of the vagus nerve or nucleus from pressure of the medulla. The patient had not thought it worth while to mention these symptoms, but when questioned, had a distinct remembrance of having had numerous such attacks for two years.

Dr. Cushing concurred in the diagnosis of a tumor in the cerebellar pontine angle, and on May 20 performed a successful operation.

The patient was laid upon the table, face downward, the body being supported by pads beneath the shoulders, which were adjusted before the anesthetic was given, and the head was supported by a special crutch adjusted to the forehead, not attached to the table, and after she was comfortably arranged the anesthetic was administered by a physician sitting beneath the table. A bow-shaped incision was made across the occiput and extended over on both sides to the ear, and a vertical incision in the median line was made downward from the middle of this bow-shaped cut. In this way two triangular flaps were made downward and outward, as indicated in Fig. 3. When the occipital bone in its entire surface had been exposed, small trephining openings were made on each side, and the opening was then enlarged by rongeur forceps until all of

the central part of the occipital bone had been removed. The median ridge between these two openings was then rongeured away and the bone was taken away down to the foramen magnum. The posterior third of the bone forming the foramen magnum was also removed, it being evident that the brain within the dura was pressing downward into this foramen. When the occipital bone was thus entirely taken away and the foramen had been opened, it was evident that the intracranial pressure had abnormally increased, as the dura bulged markedly from the opening made, and when the dura was opened the compression of the cerebellar tissue beneath

FIG. 3.—Showing field of operation eighteen days after it.

it was manifest not only by the bulging, but by the existence of a marked ridge upon the cerebellar tissue, showing the pressure that had been exerted along the edge of the foramen magnum, and the cerebellar tissue had evidently been forced downward into the foramen at least three-quarters of an inch below its upper level. This appearance of the cerebellum, having been forced downward into the spinal canal, confirms the statement made of the existence of such pressure, and of the possibility of such pressure producing sudden death by compression of the medulla. It is undoubtedly a fact that this patient would have died suddenly had this operation not been performed, and it is hardly conceivable that such a fatal

termination could have been postponed very long in consideration of the enormous amount of pressure evident from the cerebellum.

When the margin of the cerebellum was lifted and the pia was incised, a large amount of fluid escaped, and then the cerebellum fell back into its normal position.

By careful manipulation and raising the cerebellar hemisphere upon the left side and pushing the entire organ over to the right side, access, little by little, was obtained to the deeper structures. The difficulty experienced in previous operations (Cases I and II) of obtaining access to the base of the brain was obviated in this case

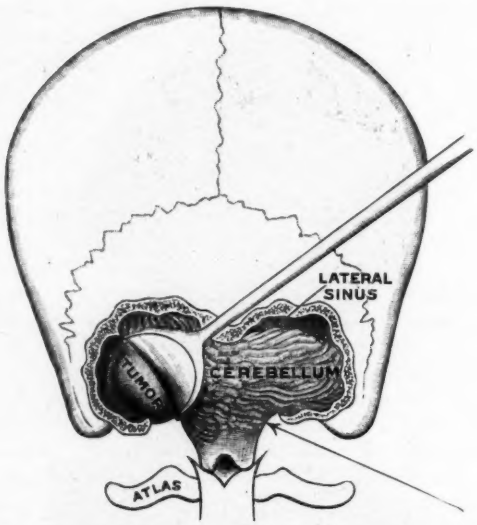


FIG. 4.—Sketch of operation by Dr. Harvey Cushing. The arrow points to the level of the foramen magnum showing the foraminal herniation of the cerebellum.

by the possibility of displacing the cerebellum over to the right side, because of the removal of the right half of the occipital bone. Had but one-half of the occipital bone been removed, it would have been impossible to have exposed the deeper structures or to have reached the tumor. When the cerebellum was elevated sufficiently a white, hard mass was discovered by the finger and soon came into view, the wound being illuminated by a powerful electric lamp attached to the operator's head (Fig. 4). This tumor was evidently encapsulated, was not attached to the surrounding structures excepting by a small pedicle at its base; by careful manipulation with the finger and a spoon it was enucleated, its pedicle severed, and it was removed with a very little hemorrhage. Such hemorrhage as there was, was arrested by packing with cotton wet with

adrenalin solution. The removal of the tumor enabled the operator to have space enough to return the cerebellar tissue easily within the dura. The cavity left by removal of the tumor was filled by a sterile salt solution. There had been no laceration of the cerebellum attendant upon the operation. The dura was closed, the scalp sewed with silk sutures, and although the operation had occupied more than two hours, the patient had no perceptible shock, and on recovering from the anesthetic, was found to be very comfortable. She made a steady progress to recovery. Fig. 3 shows the condition of the scalp at the site of the wound eighteen days after operation.

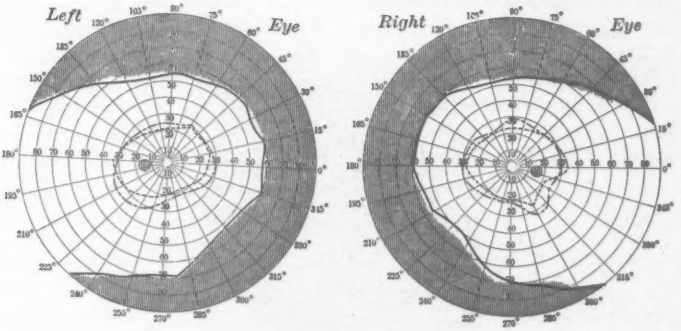


FIG. 5.—Visual fields one month after operation: very slight inversion persists; the blue field is generally larger than the red. (Dr. Bordley.)

Careful examination on June 18, one month after the operation, by Dr. Cushing, elicited the following facts: There was no sign of headache; there was a complete disappearance of numbness in the leg, arm, and face; there was no ringing in the ear; there was a marked subjective improvement in vision, and the visual fields showed a regaining of the normal contour, both for white and for color, a marked enlargement of the visual field for color being evident. The disks were reduced to 1.5 D. She was able to walk more steadily than for many months, but still felt a certain uncertainty in her gait, but had no tendency to stagger to one side. Her old discomforts associated with a change of position had disappeared. She was now able to lie on her back or on either side in bed. She had no longer any sensation of falling; the diminished acuity of hearing in the left ear to air conduction had practically gone, although there was a slight deafness still to bone conduction; the awkwardness in the left hand had disappeared. The only remaining evidence of the old lesion was the nystagmus of the eyes and the increased knee-jerks.

The appearance of the tumor is shown in Fig. 6, together with measurements in centimeters. The size of the tumor is 2.5 cm. in two of its diameters, and 2 cm. in the third diameter. It is a hard, white, encapsulated tumor, presenting the appearance of a fibroma, and was found to be, on microscopic examination, a pure endothelioma.

The examination of this patient, on February 5, 1910, shows a state of almost perfect health. She has no choked disks, the retinæ appear to be normal, her visual field is perfect for light and for color, and there is no congestion of the veins of the retina. She walks perfectly well, without any tendency to stagger, and has no vertigo. She has had no headaches during the summer. She has no anesthesia or weakness of any part of the face or body.

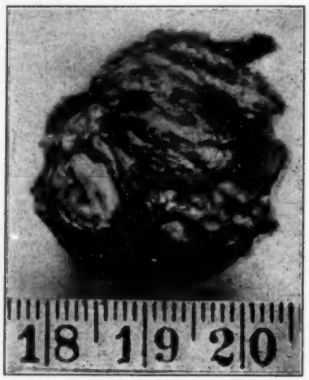


FIG. 6.—Endothelioma of acoustic nerve (centimeter measure)

She has nystagmus on lateral motion of both eyes, a slight deafness to the tuning-fork and to air conduction in the left ear, and exaggeration of both knee-jerks, but no ankle clonus, and she feels perfectly well. She goes about New York alone, her hair has grown naturally over the wound, and there is no tenderness of the scalp. The marked exophthalmos which was present has gradually subsided, so that there is no trace of it at present, and her winking is symmetrical on both sides.

The interest of this case lies, first, in the possibility of an accurate localization of the tumor, as shown by the analysis of the symptoms; second, in the possibility of successful removal when a sufficient field of operation is obtained by an extensive removal of bone; and third, in the fact that when such a tumor, lying upon the brain without destroying the brain tissue, is removed, a complete recovery of function in the brain tissue previously compressed is quite possible.

OPERATIONS FOR TUMORS OF THE CEREBELLUM AND ACOUSTIC NERVE. In the early days of cerebral surgery the results of cerebellar operations were so unfavorable as to make surgeons unwilling to undertake this operation, but as greater care and skill were developed, and the technique was improved, successful cases were more frequently recorded, so that, year by year, the percentage of recoveries increased. In 1905 Frazier was able to collect the records of 116 cases of cerebellar tumor in which an operation had been undertaken. In 52 cases the tumor had been found at the operation; in 34 cases it had been removed successfully, and in 17 cases recovery from the operation and from many of the symptoms which had been present prior to the operation had occurred. I have been able to collect from the literature between January 1, 1905, and January 1, 1910, 128 cases in which an operation had been undertaken, in which the tumor has been found and in which it has been removed (the tables of these cases are appended). I have not included in these tables cases in which an operation has been undertaken but in which no tumor was found, although there are nearly 50 such cases of failure recorded in the literature in the last five years. The analysis of these tables shows:

	Cases.
Tumors of the cerebellum removed, with recovery of patient	76
Tumors of the cerebellum removed, with death of patient	52

Constructing a table from the combination of statistics of Frazier and myself up to January 1, 1910:

	Cases.
Total number of operations for cerebellar tumor	294
Tumors found and removed	162
Recovery of the patient from operation and from symptoms	69

By the term recovery it is intended to imply not merely survival of the patient after the operation for a few days, but relief from the symptoms present in greater or less degree for a period exceeding three months. It is true that some of these patients remain with imperfect sight or hearing, and that some have remained somewhat ataxic in their gait, or with partial paralysis of some one of the cranial nerves. On the other hand, a number have been reported as completely recovered after several months, or even years, one case of Ballance having survived the operation already twelve years when the report was made.[16] In the case described in this article I see every reason to believe that the patient is permanently well, as she shows few, if any, symptoms at the end of ten months.

Such results certainly justify the operation, and make it evident that, as experience grows and technique is perfected, the many

[16] Ballance, Some Points on the Surgery of the Brain, p. 281.

dangers of the operation will be overcome, the operation will be undertaken earlier, and the percentage of recoveries will steadily increase.

The Method of Operation. A study of the various methods recommended by Horsley, Ballance, Borchardt, Krause, Biro, Frazier, and Cushing has convinced me of several important facts:

1. The necessity of a large exposure of the cerebellum by a bilateral operation, exposing and removing the entire occipital bone. Such an operation is long and difficult, the hemorrhage from the soft tissues and muscles of the neck is liable to be excessive, and in many instances an exposure of the occipital bone reveals foramina in that bone traversed by veins, giving the bone a cribiform appearance, which give rise to very severe hemorrhage. Thus, in a case of cerebellar tumor operated upon for me by Dr. McCosh, in 1900,[17] it was absolutely necessary to stop the operation on the exposure of the occipital bone, to plug the sinuses which were open with wax and with ivory points, and to give up any idea of further procedure, arresting the hemorrhage by bandages, the removal of which on the second day was followed by such a considerable degree of hemorrhage that any further attempt at removal of the bone was abandoned. The blood flowed through the foramina in the occipital bone in continuous stream, as if from a sinus, and the bone, which had been probably somewhat thinned by the pressure of the tumor within, bled freely wherever it was touched with an instrument. Others have found the same difficulty, but in cases of hemorrhage it is sometimes possible to arrest the hemorrhage by insertion of Horsley's wax into the bleeding foramina, or by plugging small openings with bone points or with wooden plugs.

2. A bilateral operation, removing the bone from both sides of the cerebellum, and then removing carefully the intermediate ridge of bone lying vertically between the two halves of the cerebellum over the occipital sinus, is necessary in order to give proper space for the displacement of the cerebellum to one side or the other during the operation, so that access may be had to the deeper parts in cases in which the tumor lies in the pontine angle. When only one side of the occipital bone is removed, the space opened is rarely more than two inches in diameter. Through this opening the cerebellum bulges greatly when there is a tumor within it or beneath it, and thus the cerebellar tissue stands in the way of any access to the deeper parts. In one case operated upon by Dr. McCosh,[18] under these circumstances, about one-half of the cerebellar hemisphere was sliced away and removed, much of it having become bruised and lacerated through bulging outward and by the necessary manipulations. This loss of cerebellum did not appear

[17] This case is not included in those already cited—Case V in my table.

[18] This case is not included in the cases here cited. Case VII.

to have any ill effects subsequently upon the patient. Horsley has recorded a similar case,[19] in which a considerable part of the cerebellar hemisphere was destroyed in an operation without any ill effects. Hartley[20] also records a case in which a half of the cerebellar lobe was removed in an operation for the removal of a cerebellar tumor, where no tumor was found, but a decompression only was accomplished, in which case the patient recovered perfectly, and was well three years later, without any symptoms referable to a loss of one-half of the cerebellar lobe. While it appears, therefore, that a destruction of cerebellar tissue may be survived without any permanent ill effects, even to the extent of one-half of a cerebellar hemisphere, yet such a destruction of the cerebellum may be avoided by a bilateral exposure.

3. One of the dangers attendant upon this operation, and one which has led to sudden death during or immediately after the operation, is traction upon or pressure upon the vital centres in the medulla oblongata during the operation. If plenty of space is obtained for the displacement of the cerebellum to the side away from the tumor, by a large exposure, such pressure and traction may be avoided. It seems, therefore, incumbent upon the operators to expose the entire cerebellum before attempting to extract the tumor.

4. Inasmuch as this exposure is a difficult matter, involving considerable hemorrhage and taking a long time, it seems advisable that this operation should be completed and the removal of the tumor attempted at a second operation, to be done from five to ten days after the first. In this way shock, which is the second chief danger in these operations, may be avoided. Furthermore, the removal of the occipital bone relieves the intracranial pressure at once, and in some cases in which the tumor subsequently was not found, this decompression in itself has been sufficient to cause great improvement in the symptoms. Thus, I desire to put on record here the history of a case of a young man sent to us from Charleston, S. C., the son of a physician, who was operated upon by Dr. McCosh, in the Presbyterian Hospital, in 1902.

Case VII.—*Probable cerebellar tumor; decompression; recovery.* This young man presented all the general symptoms of tumor—headache, vertigo, vomiting, and optic neuritis—together with marked cerebellar ataxia and tendency to stagger backward, but without any symptoms referable to the cranial nerves or to the tracts passing through the pons and medulla. The tumor was, therefore, thought to be in the middle lobe of the cerebellum and beneath the tentorium, and not near the base.

In this case both halves of the cerebellum were exposed by a free removal of the occipital bone, but no tumor was to be found

[19] Brit. Med. Jour., August 23, 1906.

[20] Annals of Surgery, xlv, 518.

after careful exploration with the finger and with an aspirating needle in all directions. The operation, which was followed by immediate surgical recovery, was succeeded by a general progressive improvement, the choked disk gradually subsiding, though the sight did not improve materially, as permanent damage had been done to the optic nerves, but his headache, vomiting, and vertigo were relieved, his ataxia disappeared, and he went home at the end of two months fairly well, and has been heard of at intervals since, having been apparently entirely relieved from his symptoms, excepting for a moderate degree of blindness. The last report was four years after the operation.

Similar cases have been recorded by Cushing[21] and by other operators, and in Frazier's statistics 13 per cent. of the patients were improved by the operation, even when the tumor was not removed. The relief of pressure, therefore, at the first operation, is likely to improve rather than to hurt the patient.

5. In the second operation, or the second stage of the operation, the first step is to prevent hemorrhage from the occipital sinuses, by tying them with an aneurism needle and double suture before the dura is divided. Then a transverse incision, curved upward, is to be carried from one side across to the other, allowing the dura to be reflected downward, so as to give a thorough exposure of the cerebellum. It is most important that in the removal of the occipital bone the posterior edge of the foramen magnum should also be removed. In a large number of the cases of cerebellar tumor a portion of the cerebellum is wedged down into the spinal canal. If the posterior portion of the foramen is removed, the cerebellum can easily be loosened and turned upward without undue traction. When the dura is divided the cerebellum may be lifted upon the spatula, and exploration of the cerebellar pontine angle may thus be made. In this procedure the cerebellum has to be pushed over to the opposite side, and anyone who has watched this operation will realize at once this procedure, which is essential to the discovery and removal of a deep tumor, is practically impossible unless both lobes of the cerebellum are exposed and plenty of free space for the dislocation of the cerebellar hemisphere toward the middle line is allowed for. In the case here recorded, which was operated upon by Dr. Cushing, unless this procedure had been feasible, it would have been practically impossible to get access to the deep tumor, which lay at least three inches below the surface of the dura.

6. A study of the records of cases operated upon and here cited has shown that in many cases laceration of the acoustic or facial nerve has occurred during the removal of the tumor, and more frequently still, laceration of deep-lying bloodvessels has been attended by

[21] Surgery, Gynecology, and Obstetrics, 1906. This was a case first seen by me, in which I recommended the operation.

hemorrhage, not only difficult to control at the time, but subsequently leading to a fatal termination. Such hemorrhage can only be avoided by great care in the extraction of the tumor, by tying such vessels as are seen to pass into its space prior to its removal, and by a free access to the cavity after the tumor has been removed, so as to allow for tying any vessels that are still actively bleeding. If hemorrhage is entirely arrested at the completion of the operation, and no oozing occurs into the cavity left by the removal of the tumor, it is perfectly safe to close up the wound completely without drainage. This was done in the operation by Dr. Cushing, here described, with a consequent primary union of all the sutures in the scalp, with, practically, recovery from the operation on the twelfth day.

There appears to be no reason why the occipital bone should not be entirely removed from a patient. An osteoplastic flap is extremely inconvenient and practically impossible to make in this region of the skull, especially if the posterior portion of the foramen magnum is to be removed. The thickness of the muscle and fascia at the back of the neck is such that it gives adequate support to the brain, and the absence of the occipital bone consequently leads to no discomfort. In the patient whose history is here recorded, and who is now practically well, there has not been any pressure upon the scalp, there is no pulsation to be felt through the scalp, there is no weakness in the muscles moving the head, the hair has grown as thickly as ever, and in itself acts as a protector, and the patient suffers no inconvenience from the loss of her occipital bone.

THE PATHOLOGY OF TUMORS OF THE ACOUSTIC NERVE. The study of the nature of the tumors found and removed has an important bearing upon the prognosis in operations for brain tumor. A recent study of the pathology of acoustic tumors by F. Henschen[22] has shown that of 145 such tumors examined, 133 were solitary and 12 were multiple.

As regards the solitary tumors, it is interesting to note that a large majority were fibromas or fibrosarcomas, or cysts, encapsulated, non-adherent, and, from the standpoint of the pathologist, removable surgically. It is, therefore, evident that the danger of relapse after an operation for an acoustic tumor is far less than in cases of tumors elsewhere. Henschen calls attention to the fact that the acoustic nerve is the only cranial nerve frequently affected by a tumor. He brings this fact into relation with the observation that in embryonal growth the bone tissue which surrounds the acoustic nerve is formed later than that about the other cranial nerves, at their exit, and hence that embryonal connective tissue persists around this nerve later than elsewhere. He shows that tumors of this nerve usually (in 8 cases out of 9 examined by him) have a small pedicle entering the acoustic foramen or internal

[22] Hygeia Festbund, 1909, No. 14.

auditory meatus, the nature of which is fibrous, and he suggests that it is the proliferation of this fibrous embryonal connective tissue which gives rise to the tumor. In 83 of the 145 cases examined by him such fibrous tissue was found in the tumor.

As regards multiple tumors of the acoustic nerve, these have been observed not only by Henschen, but by many others.

Henneberg and Koch[23] made a large collection of tumors involving the cranial nerves, especially the nerves in the cerebellar pontine angle, occurring as part of a general neurofibromatosis. They showed that tumors of this angle may be multiple, occurring in some cases on both sides, and Umber[24] records a similar case. Funkenstein[25] also records a case of bilateral tumors in the pontine angle which were found at an operation; both tumors were removed, and the patient died with respiratory paralysis soon after the operation. He reports at the same time four other cases, with autopsy, in which no operation was attempted. Sachs[26] has reported a case of multiple tumors in the pontine angle.

The possibility of such multiple tumors has always to be regarded in making a diagnosis, especially as symptoms referable to the cranial nerves on both sides have not infrequently been observed, but bilateral symptoms do not always indicate multiple tumors. In cases with autopsy it has been found that pressure of the tumor upon one side not only implicated the nerves upon that side, but also displaced the pons and medulla toward the opposite side so as to cause compression of the cranial nerves upon the side opposite to the tumor, thus producing the bilateral symptoms. This fact should not, therefore, preclude operation.

The frequency with which cysts occur in the cerebellar pontine angle is not to be overlooked.[27] And this fact leads me to mention the advisability of an exploratory puncture of the brain prior to a more extensive operation, as having a very direct importance in cases of tumor of the acoustic nerve. While it is well known that puncture of the brain through a very small hole in the skull by an aspirating needle, long ago suggested by Dr. Robert Abbe in this city, but recently performed and urged by Neisser and Pollack,[28] and by Pfeiffer,[29] is being constantly performed in German clinics, I have not found any records of its adoption in this country. Experience in Germany has shown that it is a harmless operation. The scalp is frozen, a small gimlet or drill is driven through the skull, a guard preventing its puncture of the dura, a small cannula with oblique end is pressed into the brain, and aspiration is employed

[23] Arch. f. Psych., 1902, xxxvi, 251.
[24] Neurolog. Zentralbl., 1907, p. 91.
[25] Mittl. aus der Grenzgeb. d. Med. u. Chir., xiv, 157.
[26] Jour. Nerv. and Ment. Dis., 1906.
[27] See Schols, quoted by Henschen, Hygeia Festbund, 1909, No. 14, where 75 cases are analyzed.
[28] Mittheilungen aus d. Grenzgeb. d. med. u. Chir., 1904, xiii.
[29] Arch. f. Psych., xlii, 2.

by a syringe. Thus, a small cylinder of brain tissue is obtained which may reveal tumor elements; or a cyst may be tapped which can readily be emptied by the aspiration.

Baisch[30] reports 2 cases of acoustic tumor in which puncture revealed the existence of a cyst. In the first case the subsequent operation showed it to be a part of a glioma, which was successfully removed, with the recovery of the patient. In the second case the evacuation of the cyst through aspiration was followed by such marked improvement that no operation was found necessary, and the patient was reported as recovered. In view of these facts, is it not incumbent upon us to urge this method of diagnosis in all brain tumors?

TUMORS OF THE CEREBELLUM FOUND AND SUCCESSFULLY REMOVED, WITH RECOVERY OF THE PATIENTS FROM THE OPERATION.

1904. Stewart and Holmes, Brain, xxvii, 560. 11 cases.
1904. F. R. Fry, Jour. Nerv. and Ment. Dis., March. Tubercular.
1905. Borchardt, Arch. f. klin. Chir., lxxvii, 892. Cholesteatoma.
1905. Ziehen, Medizinische Klinik, p. 34. Glioma.
1906. Putnam and Waterman, Jour. Nerv. and Ment. Dis., May. Sarcoma, cyst.
1906. Horsley, Brit. Med. Jour., August 23. 9 cases.
1907. Homburger and Brodnitz, Mittl. aus der Grenzgeb. d. med. u. Chir., xix, 2. 2 cysts.
1907. Auerbach and Grossman, ibid., xviii, 1. Glioma.
1907. Schultze and Schede, ibid., xvii, 617. Glioma.
1907. Bruce, Annals of Surgery, xlv, 550. Cyst.
1907. Rubritius, Beitr. z. klin. Chir., lxiii, 447. Cyst.
1907. Oppenheim and Borchardt, Berl. klin. Wochen., xliv, 875. Fibroma, sarcoma.
1907. Ziehen, Archiv f. Psychiatr., xlv, 768. Glioma.
1907. Borchardt, Archiv f. klin. Chir., lxxxi, 181. 3 cases.
1907. Poppert, Deut. med. Wochenschr., p. 613. Fibroma.
1907. Ballance, Some Points on the Surgery of the Brain. Tubercle.
1908. Weisenberg, Jour. Amer. Med. Assoc., No. 16. Fibroma.
1908. Baisch and Narath, Beitr. z. klin. Chir., lx, 482. 2 cysts.
1908. Bramann, Berl. klin. Wochenschr., August 10. 9 cases (3 relapses).
1908. Tietze, ibid., Cyst.
1908. Adler, ibid., Cyst.
1908. Foerster, Berl. klin. Wochenschr., April 6. Cyst.
1908. Willy Meyer, Jour. Nerv. and Ment. Dis., September, p. 584. Fibrosarcoma.
1909. Jones, Boston Med. and Surg. Jour., August 26.
1909. Kuttner, Allgem. med. Central Zeitungen, lxxiii, 198. Glioma.
1909. Ziehen, Medizinische Klinik, No. 1. Cyst.
1909. Krause, Hirn Chirurgie, Berlin, 1909. Cyst.
1909. Cushing, Interstate Med. Jour., St. Louis, September. 11 cases.
1909. Grinker, Jour. Nerv. and Ment. Dis., May. Fibroma.
1909. Leischner, Arch. f. klin. Chir., lxxxix, 542. Sarcoma.
1909. Borchardt, Oppenheim, Centralbl. f. Chir., April. 2 cysts.
1909. Starr and Cushing, Present article. Endothelioma.

TUMORS OF THE CEREBELLUM OPERATED FOR AND REMOVED, WITH DEATH OF THE PATIENTS.

1904. Stewart and Holmes, Brain, xxvii, 525. 6 cases.
1906. Horsley, Brit. Med. Jour., August 23. 1 case.
1906. Funkenstein, Mittl. aus der Grenzgeb. der med. u. Chir., xiv, 157. Neuroma.
1906. Rubritius, Beitr. z. klin. Chir., lxiii, 447. Neurofibroma.

[30] Beit. zur klin. Chir., 1908, lx, 482.

1906. Bruns, Neurol. Centralbl., p. 971. 2 cases.
1906. Borchardt, Arch. f. klin. Chir., Band lxxxi. 3 cases.
1906. Poppert, Deut. med. Woch., p. 613. 3 cases.
1906. Auerbach, Deut. med. Woch., p. 614. Sarcoma.
1906. Ballance, Some Points on the Surgery of the Brain (Macmillan). 2 cases.
1908. Martens, Berl. klin. Wochensch., August 10., No. 32, Glioma.
1908. Bramann, ibid. 1 case.
1908. Tietze, ibid. Tubercle.
1908. Kredel, Centralbl. f. Chir., April, 2 cases.
1908. Siemmerling, Berl. klin. Woch., p. 701. Sarcoma, fibroma.
1908. Henschen and Dahleren, Hygiea, No. 44. Cyst.
1908. Becker, Deut. Arch. klin. Med., Band lxxxix.
1908. Ebsberg, Jour. Nerv. and Ment. Dis., September, p. 586. 1 case.
1908. Weisenberg, Jour. Amer. Med. Assoc., January. 1 case.
1908. Hunt, J. R., Jour. Nerv. and Ment. Dis., September. 4 cases.
1909. Flatau, Neurolog. Centralbl., p. 399. 1 case.
1909. Boettiger, Neurolog. Centralbl., p. 167. Cyst.
1909. Krause, Hirn Chirurgie, Berlin, 1909, p. 141. 3 cases.
1909. Cushing, Interstate Med. Jour., September, xvi, 607. 3 cases.
1909. Lomois and Durand, Ann. des mal dé l'Oreille, March. Glioma.
1909. Biggs, Lancet, July 3. Fibroma.
1909. Grinker, Jour. Nerv. and Ment. Dis., May, p. 304. 1 case.
1909. Leischner, Arch f. klin.. Chir., lxxxix, 542. Cystoglioma, Neurofibroma.

Table of Personal Cases.

No.	Name.	Age.	Situation.	Operation.	Result.	Surgeon.	Autopsy.
1	M.	30	L. hemisphere base and left pons	Tumor not found	Recovery from operation; death 7 days later	McBurney	Glioma.
2	W.	10	Cerebellar pontine angle	Tumor found and removed	Recovery from operation; death 14 days later	McBurney	Cystoglioma.
3	B.	7	Cerebellum and pons	Tumor not found	Died three weeks later	McCosh	Sarcoma.
4	G.	39	Cerebellum and pons	Tumor not found	Death 7 days after	Brewer	No autopsy.
5	C.	6	Cerebellum and pons	Bone only exposed; hemorrhage	Unknown; child taken home	McCosh	
6	G. K.	8	Cerebellum	Cystoglioma found and partly removed	Death 6 days later	McCosh	Glioma and cysts within it.
7	A. T.	11	Cerebellum	Removal of part of occip. bone; excessive hemorrhage	Improved; discharged one month later	McCosh	
8	L. H.	13	Cerebellum	Decompression; tumor not found	Improved for two years	Cushing	
9	W. F.	17	Cerebellum	No tumor found, decompression only	Death	Hartley	Sarcoma of optic thal.
10	G. H.	18	Cerebellum	No tumor found; bilateral decompression and some cerebellar tissue removed	Well	McCosh	
11	F. A.	32	Cerebellar pontine angle	Removal	Recovery	Cushing	
12	A. D.	20	Cerebellum	None	Death suddenly day before operation	McCosh	Glioma with cyst in cerebellum.
13	K.	17	Cerebellar pontine angle	None	Sudden death prior to operation	McCosh	No autopsy.

I have appended to this article the record of 13 personal cases of tumors of the cerebellum, in 11 of which an operation was performed, and in 2 of which sudden death occurred just prior to an operation which had been determined upon. Three of these cases (I, II, and III) were included in Frazier's statistics. Case VIII is included in the statistics of Cushing. The other cases have not been published.

THE TREATMENT OF HEMORRHAGE OF THE SPLEEN.

By John G. Sheldon, M.D.,
of Kansas City, Missouri.

The treatment of traumatic hemorrhage of the spleen by the methods ordinarily advised and practised is, as a rule, unsatisfactory.

Splenectomy. Splenectomy, which of course stops the bleeding, is, to say the least, an undesirable operation. It is associated with considerable shock, deprives the patient of an organ that may be of considerable physiological importance, and it is not always easily or quickly accomplished. The mortality following splenectomy for hemorrhage is approximately 50 per cent. if the operation is done soon after the injury occurs. Berger[1] collected eighty cases of wounds of the spleen treated by splenectomy not later than nine hours following the injury; in thirty-five of these death occurred within twenty-four hours.

Splenorrhaphy. The suturing of splenic wounds, recommended by Lamarchia, Madelung, and others, is an unsafe procedure. Its field of application is limited, and it cannot be relied upon to control hemorrhage in any case.

Senn's Method. Senn[2] recommends that in selected cases of splenic wounds the margins of the wound should be crushed and sutured. This method succeeded in stopping the hemorrhage in seven dogs in which incised marginal splenic wounds had been made. The application of Senn's method is limited, and on account of the thinness of the dog's spleen as compared with the human organ, it is probable that the experimental work magnifies the practical utility of Senn's procedure.

Jonnesco's Method. Ligation of the splenic vessels to control splenic hemorrhage, recommended by Jonnesco, stops the bleeding, but is followed by necrosis of the spleen, and in dogs results in death. Pirone suggested that after the splenic vessels had been tied, the great omentum might be utilized to supply nourishment to the organ, and thereby prevent necrosis. This I have tried on three

[1] Arch. f. Chir., Band xxviii, Heft 3.
[2] Int. Cong. of Med., Madrid, November 21, 1903.

dogs. In two of the animals the omentum was placed around the wounded spleen after the splenic vessels had been ligated. One dog died twelve hours later and the other died in thirty-two hours. In each the spleen was necrotic and showed no evidence of blood being supplied by the great omentum. In the third dog the omentum was too small satisfactorily to encircle the spleen. The animal died forty-eight hours after the splenic pedicle was ligated. The spleen was necrotic throughout.

OTHER METHODS. Tamponing, the use of the cautery as recommended by Rehn, the use of hot air and steam recommended by Snegnireff, and the injection of heated air into the abdominal cavity advised by Kelling to control splenic bleeding, would seem too insecure for practical work. The work of Hartin Jordan,[3] who has successfully done partial resections of the spleen in dogs, indicates that resection may be utilized in treating certain splenic wounds.

The results obtained by the methods afore-mentioned show that in 168 splenic wounds collected by Berger, 86.3 per cent. died from hemorrhage within twenty-four hours. An attempt to make it possible to reduce this mortality in the future has been the stimulus that has led to the presentation of a method for treating splenic wounds that has not, to my knowledge, been described.

METHOD ADVISED. The procedure that I shall describe for the treatment of wounds of the spleen consists of the application to the splenic pedicle of a large flexible clamp, the blades of which are protected with rubber tubing, sufficiently tight to occlude the vessels but not to crush them. This clamp protrudes through the abdominal incision and is left in place for four hours. Then it is unlocked. If no bleeding occurs—as can be determined by the appearance of fresh blood in the wound, and the condition of the patient—the clamp is removed. The splenic wound is not treated in any way. After the splenic circulation has been shut off by the clamp, the vessels in the splenic wound empty themselves by draining into the peritoneal cavity and their cut ends are occluded by nature sufficiently firmly in four hours to prevent bleeding when the splenic circulation is reëstablished by removing the clamp. If the wounded splenic vessels are prevented from emptying themselves, which can be done by tamponing or suturing the wound, the thrombosis started at the splenic wounds extends to the clamp on the pedicle and prevents the reëstablishment of the splenic circulation after the clamp has been removed.

Principles Involved. The principles involved in the method herewith described are active in almost every surgical undertaking. The occurrence of the spontaneous arrest of hemorrhage is generally admitted. I think it can also be stated without argument that the

[3] Lancet, January 22, 1899.

escape of blood from the severed vessels is a most potent factor in preventing the spontaneous arrest of the bleeding by mechanical washing away the beginning thrombus. The arrest of the circulation through a severed vessel removes this obstacle to thrombosis and permits a rapid closure of the vascular wound. This is shown in wounds of the extremities in which hemorrhage has been controlled by elastic constriction above the wound. In such cases, if the constrictor has been placed a few hours, many times no bleeding occurs after its removal, even when vessels of considerable size have been severed. I have seen, in one case, spontaneous occlusion of the popliteal artery. A car wheel completely divided this vessel one inch above the knee joint. A constrictor applied to the thigh controlled the hemorrhage. and when the constrictor was removed six hours later, the divided artery and veins did not bleed. I have severed three femoral arteries in dogs and have applied protected clamps to the vessels about two inches above the wounds. Removal of the clamps four hours later was followed by no hemorrhage from the divided vessels.

In applying this principle to the spleen, experimentation was necessary to determine the length of time that the forceps should be left in place to permit a firm occlusion of the wounded splenic vessels. The spleens of two medium sized dogs were wounded by making two incisions on the outer surface of each spleen about two and a half inches long and nearly through the thickness of the organ. One wound was made in the longitudinal direction, the other very obliquely. The clamps were removed in six hours, and the bleeding was completely and permanently arrested. In two other dogs, very deep wounds were made at the middle of the spleen. There was no bleeding after the clamps were removed six hours later. In five dogs, incised splenic wounds were made (usually two large wounds in each organ) and the clamps left in place four hours. In no case did hemorrhage follow removal of the clamps. In one dog, three deep wounds were made in the spleen and the clamp removed at the end of three hours. Apparently no bleeding followed, but when the dog was killed one week later, a clot one inch in diameter was found in one of the wounds and the omentum was adherent around the clot. Clamping of the splenic pedicle for from three to six hours in ten dogs was followed by spontaneous permanent arrest of the bleeding in each instance.

Reëstablishment of the Splenic Circulation. In the spleen of ten dogs, the splenic circulation was completely reëstablished after the clamps were removed. This was shown by histological examination of the organs—the dogs being killed from twelve hours to three weeks after the experiment. The vessels at the site of clamping showed no evidences of injury. The intima was smooth in every case. In the dogs killed earlier than one week, the site of clamping could be located, but in those killed later it was impossible to

determine that a clamp had been applied. The splenic wounds in the dogs killed early were covered with plastic material; later complete healing by fibrous tissue was observed, and in two instances of gaping wounds the great omentum was adherent in the wounds. It seemed evident that the thrombosis in the splenic wounds did not extend beneath the surface, as the spleens were macroscopically and histologically normal close to the incisions. It would seem then that the splenic vessels distal to the clamp were emptied by being drained through the wound into the peritoneal cavity, and for this reason they did not thrombose or prevent a reëstablishment of the circulation. If some of them did not drain and remained filled with stagnant blood, thrombosis would not be expected, as it was shown by Senn and Bumgarten that stagnant blood in a vessel, the intima of which was uninjured, did not clot. Now, if the splenic vessels are not allowed to drain, but are kept filled with blood, the thrombosis started at the wound extends in a proximal direction, and may even extend to the clamp—preventing the reëstablishing of the splenic circulation, and resulting in partial or complete splenic necrosis. This was determined by suturing the splenic wound and then applying a clamp to the splenic pedicle. In four dogs, two incised wounds were made in the spleen. One was sutured; the other left open. A clamp was applied to the pedicle. In these specimens, necrosis was found in the portion of the spleen in which the sutured wound was located, while the tissue about the open wound was normal. In one dog, two splenic wounds were sutured and a clamp applied. The animal died on the fourth day from peritonitis. The spleen was necrotic, and the splenic vessels occluded by a thrombus. From the foregoing, I conclude that if a clamp is to be applied to the splenic pedicle to control hemorrhage, the splenic wounds should not be sutured or packed, but the cut vessels should be allowed to empty themselves—otherwise thrombosis and more or less splenic necrosis may be expected.

Splenic Necrosis. In none of the experiments performed was there evidence obtained that would suggest that anemic necrosis of the spleen might be expected to occur after the circulation had been shut off for six hours. If, however, the clamps are left in position for ten hours, necrosis may be expected. In two dogs the clamps were left in place ten hours. One died on the fourth day, the other on the sixth. In both the spleens were markedly necrosed, especially around the wounds. But as an anemia of four hours' duration seems sufficient to control splenic bleeding, and if splenic anemic necrosis does not follow unless the circulation has been shut off for more than six hours, the danger of splenic necrosis offers no barrier to the practical application of this method.

Technique. In making use of this method to treat splenic wounds, it is suggested that a flexible clamp be used, and the blades well

protected with rubber tubing. The pedicle should be clamped only sufficiently tightly to stop the bleeding, although considerable pressure is necessary to injure the intima sufficiently to result in thrombosis. The clamp should be left in place four hours, then loosened but not removed. If no bleeding occurs, the clamp may be removed; if the hemorrhage resumes, the clamp should be closed for another four hours. It would seem that this could be carried on for several hours, for the intermittent loosening of the clamp would renew the splenic circulation and prevent necrosis.

Limitations of the Method. It is not believed that this method is applicable in treating all splenic wounds. On account of the absence of, or slight, anastomosis between the splenic vessels, wounds severing large vascular trunks at or near the splenic hilum should be treated by splenectomy, for although clamping might stop the hemorrhage, splenic necrosis would follow. In all other wounds of the spleen, I see no objection to the application of the methods herewith described.

Since the foregoing was written no case of wound of the spleen has fallen into my hands, so I have not had an opportunity to test the method. Besides the experiments herewith recorded, eight additional similar experiments have been made; and, as the results and observations coincided with the previous work, they will not be described.

REVIEWS.

SEMMELWEIS. HIS LIFE AND HIS DOCTRINE; A CHAPTER IN THE HISTORY OF MEDICINE. By SIR WILLIAM J. SINCLAIR, M.A., M.D., Professor of Obstetrics and Gynecology in the University of Manchester. Pp. 369; 2 illustrations. Manchester: The University Press, 1909.

IN the rush and hurry and necessary overcrowding of the medical curriculum of the present day, it seems in vain to hope for any adequate consideration of the lives of the great in medicine; we wish, therefore, that it were possible to place this book in the hands of every doctor in America. It may be likened to a photograph of some wonderful monument. It is certainly a great tribute to the author that, after finishing the reading of the work, the reviewer found himself absolutely unable to criticise its technique, since he was left with but an imperfect idea of the constructive details of the book, having been entirely engrossed by the wonderful appeal of the story of Semmelweis. "In the history of midwifery there is a dark page, and it is headed Semmelweis," and the fact that a great deal of the personal suffering and misrepresentation could have been avoided by a man of a different mental make-up does not lighten the blackness of the story.

"Theology had a Luther, physical science a Galileo, biology a Servetus, but in the history of obstetrics there has been but one Semmelweis." The volume opens with an introductory section dealing with the early life of Semmelweis; this is followed by a chapter upon his life as an interne in the Vienna Maternity Hospital, an account of the doctrines prevalent before his time relative to the etiology of puerperal fever, some account of his early professional friends, and a most interesting description of the deductive reasoning employed in arriving at the conclusions which constitute the "Lehre." The remainder of the body of the work is taken up with a consideration of the attitude of the profession of the day with regard to the discovery, and quotations are given from the voluminous correspondence between Semmelweis and his most noted adversaries and adherents, the latter being sadly few in comparison. In considering the attitude assumed by the profession in America, the author devotes several pages to the well-known contribution of Holmes, stating that "if Semmelweis could have written

like Holmes, his *Ætiologie* would have conquered Europe in twelve months," but affirming with considerable heat that any comparison between the services rendered by Semmelweis and Holmes is preposterous. We assume from the prominence given by Sinclair to the matter that somewhere and somehow he must have gained good and sufficient reasons for the outburst, but we believe that all intelligent members of the profession are well informed as to the part played by the essay on the "Contagiousness of Puerperal Fever." There can be no question as to the great influence exerted by it at a time when the obstetrical seats of the mighty were occupied by crystallized obstructionists, and no one would have been less likely to have claimed scientific equality with Semmelweis than the genial "Autocrat." On the other hand, we have enjoyed the justifiable arraignment of other members of the American profession of that day, but we feel that the animadversions upon Holmes are unnecessary.

Doctor Sinclair deserves the thanks of the whole English speaking profession, and we feel sure that the perusal of the work will not be limited to them, for having brought the story of this life within their reach. It is a sad story, and it does not make very pleasant reading. It is not the story of Jenner, of Lister, or of Morton, all of whom saw at least in part the results of their labors: but it is the story of a man led by his love of humanity into attacking conditions which seem at the present day beyond imagination; it is the story of a man endowed with a mind which would not allow the supine acceptance of the dictum of authority, but who through his unaided observations obtained conviction in the face of persecution: and finally it is the story of a man dying insane after his whole life had been embittered by the neglect, not of himself—for no one can read this history without being convinced that he realized the greatness of his discovery and never for long doubted his ultimate triumph—but embittered by the neglect of his teachings with the consequent continuance of the slaughter which it had been his lifelong aim and hope to eradicate. W. R. N.

THE ELEMENTS OF HYGIENE FOR SCHOOLS. BY ISABEL MCISAAC. Late Superintendent of the Illinois Training School for Nurses. Pp. 172; 31 illustrations. New York: The MacMillan Co., 1909.

IN her book on *Hygiene*, Miss McIsaac has succeeded in presenting the subject, divested of much needless detail, in a way so concise and clear as to render it at once interesting and easily understood by the average pupil in our elementary schools. Before proceeding with the subject of hygiene proper, the author wisely devotes a

chapter to the subject of bacteria. She points out the vast economic value of bacteria as well as their pathogenic properties, and emphasizes the all-important role played by bacterial activity in the maintenance of life upon the earth. The chapter on food is comprehensive, being divided into five sections which deal with the relative value of various dietaries, the preparation of food, and the preservation and adulteration of food. Relatively too much space is devoted to the consideration of the latter subject. Though it is undeniably important, it seems unnecessary to quote at length, for the benefit of elementary students, from government reports, as to what is technically understood under the law by the terms "misbranded" and "adulteration." Climatology and ventilation, including heating and lighting, are next discussed; then follows a consideration of the subjects of water supply and filtration and the disposal of sewage and garbage. After taking up personal, household, and school hygiene from a useful, practical standpoint, Miss McIsaac discusses the effect of occupation on health, especially calling attention to the present status of child labor and the employment of women in the United States. A consideration of the various methods of disinfection and quarantine concludes the book. It is worthy of comment that in the entire book less than two pages are devoted to the alcohol question. Furthermore, the writer unhesitatingly quotes the dictum of Liebig, who held that "The use of spirits is not the cause but the effect of poverty." Here is, indeed, moderation, as rare as it is praiseworthy when encountered in a school text-book, the majority of which contain the most flagrant misrepresentations of the facts regarding alcohol.

On the whole, Miss McIsaac has well summarized the important phases of hygiene, and has, in addition, introduced much information on practical details which should make her book of value not only to the student, but also to teacher and parent. G. M. P.

HYGIENE FOR NURSES. By ISABEL MCISAAC. Pp. 208. New York: The Macmillan Company, 1908.

BACTERIOLOGY FOR NURSES. By ISABEL MCISAAC, of New York. Pp. 179. New York: The Macmillan Company, 1909.

ANATOMY AND PHYSIOLOGY FOR NURSES. Compiled by DIANA CLIFFORD KIMBER. Third edition, revised by CAROLYN E. GRAY, R.N., Assistant Superintendent of the New York City Training School for Nurses. Pp. 438; 212 illustrations. New York: The Macmillan Company, 1909.

MISS MCISAAC'S *Hygiene for Nurses* is an excellent little book, well adapted to its purpose—that of providing for the young pupil nurse a text-book practical and within the range of her daily work

and power of assimilation. It contains brief accounts of food, air, soil, water, sewage, garbage, the causes and dissemination of disease, personal hygiene, household hygiene, school hygiene, the hygiene of occupation, the employment of women and children, disinfection, and quarantine. The statements have been in large part drawn from the works of standard authorities, but all have been well arranged and tinctured with the sane advice and practical experience of the authoress.

Miss McIsaac, well and favorably known as the author of *Primary Nursing Technique, Hygiene for Nurses, and Hygiene for the Use of Public Schools*, has prepared what should prove to be an exceedingly useful book on bacteriology for nurses. It discusses in plain and simple language the essentials of the structure, mode of development, and composition of bacteria, the effect of physical and chemical agents on bacteria, the effects of bacterial growth, the relation of bacteria to disease, immunity, inflammation, suppuration, the infectious diseases, and bacteria in the air, soil, water, and food. In addition, there is a schedule for twelve laboratory exercises of two-hour periods, which, however worthy the object sought to be subserved, seems somewhat in advance of the real needs of nurses. The book, nevertheless, is to be commended.

It suffices, perhaps, to mention the publication of a new edition of Miss Kimber's *Anatomy and Physiology for Nurses*, since the book itself is one of the best known and justly prized on the subjects of which it treats. Miss Gray, in preparing the new edition, has added the Basle nomenclature as far as practicable, a preliminary chapter on physical, chemical, and biological definitions, explanatory notes, summaries at the end of each chapter, and a number of new illustrations. We may say that a really good book has been made better. A. K.

PRACTICAL GYNECOLOGY. A MANUAL FOR NURSES AND STUDENTS. By NETTA STEWART, Sister in the Gynecological Wards of the Royal Infirmary, Edinburgh, and JAMES YOUNG, M.B., F.R.C.S.E., Clinical Tutor in Surgery and late Resident Gynecologist, Royal Infirmary, Edinburgh. Pp. 327. New York: William Wood & Co., 1909.

THERE is an unfortunate and no doubt unintentioned deception in the title. It is not a practical gynecology in any sense of the term. It had better have been given a title more definitely descriptive of the actual contents and scope of the book. A short chapter upon the anatomy of the pelvis is followed by a description of the more commonly used instruments. Asepsis, the method of the examination of the patient, a description of the vaginal douche,

of the method of catheterization of the bladder and of its examination, and the usual methods of local treatment follow. The remainder of the book contains a short study of gonorrhœa, of certain of the more common operative procedures, together with the preparation and after treatment of celiotomy cases, and finally a short glossary. We believe the book to be a good one to place in the hands of nurses, and there are many points without doubt of value to the student: but we reiterate, that the title *Practical Gynecology* is entirely too pretentious, and we do not understand under what form of medical instruction it could be needed by the student of medicine, as all it contains, except the points upon nursing, forms but a small part of the ordinary text-book. W. R. N.

HUMAN PHYSIOLOGY. AN ELEMENTARY TEXT-BOOK OF ANATOMY, PHYSIOLOGY, AND HYGIENE. BY JOHN W. RITCHIE, Professor of Biology in the College of William and Mary, Virginia. Illustrated by Mary H. Wellman. Pp. 362; 157 illustrations. Yonkers-on-Hudson, New York: World Book Company, 1909.

To all acquainted with the average "school physiology" and its inaccuracies, Prof. Ritchie's work must come as a welcome and long-needed advance. Not only has he given a concise account of the more important aspects of human anatomy and physiology, but he has succeeded in emphasizing many of the fundamental principles of biology, unfortunately too rarely brought to the attention of our school children. In addition, he has devoted a considerable portion of his text to a discussion of the elements of hygiene, and the acute infectious diseases.

In spite of the brevity which of necessity marks the anatomical and physiological descriptions, surprisingly few important phases of the subject are omitted. Occasional omissions, however, do occur. For example, in the description of the gastric juice, no mention is made of rennin; nor is the glycogenic function of the liver explained, the reader being left with the impression that glucose as such is stored in the liver. After disposing of the anatomy and physiology of a group of organs, the author discusses the hygienic measures necessary to maintain these organs in a state of efficacy and health. In this connection attention should be called to the chapter on ventilation following the consideration of the respiratory tract and an equally important one on dietetics that concludes the discussion of digestion.

The attention paid the comparative anatomy and biology is decidedly the most admirable feature of the book. The facts are stated in a way well calculated to awaken in the student an interest in all natural phenomena. Comparisons are drawn between the

skeletons, gastro-intestinal tracts, nervous systems and other organs of the several classes of vertebrates, thus making clear in a striking manner the various portions of the lower animals that have their homologues in man.

Much discredit has been brought upon elementary text-books of physiology because of the gross misstatements and inaccuracies with which they abound in reference to the effects of alcohol and tobacco. Although, in the present instance, the author has neglected no oportunity to emphasize the evils which may result from the use of these drugs, he has been content to adhere to known facts, without resorting to fanatical misrepresentation. At times his statements tend to be too sweeping, as when he says that practically everyone who uses alcohol uses too much of it, but upon the whole his views are in accord with the opinions held by recognized clinicians and pathologists. As a clear, accurate summary of the structure, functions, and hygiene of the human body, well adapted for schoolroom use, Prof. Ritchie's *Physiology* can be unhesitatingly recommended. G. M. P.

THE OPEN-AIR TREATMENT OF PULMONARY TUBERCULOSIS. By F. W. BURTON-FANNING, M.D., F.R.C.P., Honorary Visiting Physician to the Kelling Open-air Sanatorium. Second edition; pp. 184; 6 illustrations. New York: Paul B. Hoeber, 1909.

THE book possesses merit, for it is a rather concise portrayal of the conditions incident to open-air treatment in pulmonary tuberculosis. A very thorough discussion of the subject of temperature is taken up, and especial emphasis is properly laid upon the value of the rectal temperature. The essential factors of open-air treatment, "air, rest, feeding, and supervision," are indeed requisites. The subject of home treatment is admirably considered, but it is accompanied by an unfortunate paucity of illustrations. Along certain lines the author asserts himself quite dogmatically. The theory of latent tuberculosis is unjustifiably upheld, and that of case-to-case infection is blotted out of consideration. It has been definitely shown that a 2 per cent. solution of chlorinated lime is inadequate to kill tubercle bacilli; yet this is recommended by him as a thorough disinfectant. His method of recording physical signs offers no advantage over the already existing schemes. Not a few statements are inconsistent, as, for example, advising spirits to be taken with milk and then deploring their use, etc. He is overenthusiastic upon the subject of opsonic work, this section having been added to the text of the first edition. The subject is attractively, concisely, and systematically presented, but a closer inspection reveals many inconsistencies. W. T. C.

A Manual of Chemistry. By W. Simon, Ph.D., M.D. Ninth edition; pp. 716; 78 illustrations and 8 colored plates. Philadelphia and New York: Lea & Febiger, 1909.

In this edition Dr. Simon, assisted by Dr. Daniel Base, preserves the same high level of work which has characterized the previous issues of his *Manual of Chemistry*. The book is essentially a guide for beginners in chemistry, but is also adaptable for students of medicine, pharmacy, and dentistry. For the latter it will be found to be more valuable as a reference work than as a text-book, since more space is devoted to inorganic chemistry than is desirable in a manual to be used by medical and dental students. To this part of the subject nearly four hundred pages are devoted. The consideration of carbon compounds is very well done in the small space allowed, and what is there offered is well chosen. A short description of all the essential groups of organic chemistry is given and is quite clear enough for the beginner in the subject. The manual closes with a brief outline of physiological chemistry (100 pages), which perhaps is too brief, but may serve as an introduction to the subject. The book well merits the favor that has been bestowed upon it.

E. H. G.

Handbook of Diseases of the Rectum. By Louis J. Hirschman, M.D., Fellow of the American Proctologic Society; Lecturer on Rectal Surgery and Clinical Professor of Proctology in the Detroit College of Medicine, etc. Pp. 374, with 145 illustrations and 2 plates. St. Louis: C. V. Moseby Medical Book and Publishing Co., 1909.

This work was written, we are assured by its author, to enable the family physician to treat the commoner rectal diseases with intelligence and success. Its aim is therefore commendable; but there must arise some question of the ability and advisability of the general practitioner converting himself into the character of an amateur specialist, if the expression be allowed. The poor, ignorant, general practitioner, on whose shoulders the burden already is so heavy, is here told not only the proper arrangement of offices, consulting room, toilet room, retiring room, etc., for "one who expects to do minor surgery or treatment work," but he is also specially instructed as to the size of the rooms to be employed: "The room should be large enough so as not to be uncomfortably crowded with the furniture and paraphernalia necessary, and yet small enough to be compact." This is a sample of the diffuseness manifest throughout the volume, which by such methods is expanded to a length of nearly 400 pages. While the author aims not to

describe any operative treatment which cannot be undertaken on patients treated as ambulatory cases, he includes in this category many procedures which are more safely performed only on those who may be kept in bed for some days subsequently, including a number in which usually a general anesthetic is to be preferred. The book is valuable in that it shows that much may be done to relieve and even to cure rectal diseases without radical operative treatment, and in that it demonstrates the efficiency of local anesthesia where usually a general anesthetic is employed. It is useless, so far as we can see, in that it neither will create rectal specialists worthy of the name, nor will be used by them; and it is harmful in that it tends to encourage incompetent charlatans to do work for which they have not been sufficiently educated previously, and for which the study of this volume alone is not a sufficient education. If rectal surgery is worthy of being considered a specialty, as is claimed by most of those competent to judge of the matter, then works such as this, which encourage amateur specialism, cannot be too severely condemned. A. P. C. A.

TUMORS OF THE KIDNEY. By EDGAR GARCEAU, M.D., Visiting Gynecologist to St. Elizabeth's Hospital and to the Boston Dispensary, Boston. Pp. 421; 72 illustrations. New York and London: D. Appleton & Co., 1909.

DR. GARCEAU'S book comprises a comprehensive discussion of renal, ureteral, perirenal, and adrenal tumors, as well as actinomycosis and echinococcus of the kidney. He has attempted to bring some order out of the chaos in which the classification of tumors of the kidneys is commonly involved, and in consequence he devotes considerable space to the hypernephromas, carcinomas, sarcomas, and malignant adenomas of the kidney. Although the distinction between the one or the other of these cannot always be made out, at least not readily, Dr. Garceau gives an excellent discussion of the etiology, pathology, symptomatology, physical examination, diagnosis, prognosis, and treatment; and he illustrates special points that he makes by the citation of cases. There are in addition chapters on embryonic tumors of the kidney, tumors of the renal pelvis and ureter, polycystic disease, and simple cysts of the kidney, and on tumors of the adrenal in adults and in children—all of which are really meritorious. The book ends with a chapter of some forty pages on the determinations of the renal efficiency. The author is much to be commended on the results of his efforts; the book is a worthy addition to contemporaneous medical literature. A. K.

RATIONAL IMMUNIZATION IN THE TREATMENT OF PULMONARY TUBERCULOSIS. By E. C. HORT, B.A., B.Sc., M.R.C.P. Pp. 75; 29 charts and diagrams. London: John Bale, Sons, and Danielsson, Ltd., 1909.

FREQUENTLY repeated is the term "hetero-inoculation," which the author has coined to imply the inoculation of an alien product: it seemed advisable to employ this expression in order to overcome the rather confusing terminology. The chapter dealing with a personal investigation of the tuberculo-opsonic index reveals nothing of note, except a portrayal of the inconsistent results of different observers with identical serums. The author's idea in reference to the charting of evening temperatures only is very good, but the lack of consideration of the morning temperatures is inadvisable. Incorporated with the chapter on spontaneous and artificial auto-inoculation, there are 27 temperature charts of cases of pulmonary tuberculosis, enteric fever, scarlet fever, influenza, bronchopneumonia, and measles, the major part consisting of the first-mentioned. The interpretation of many of the phases is purely speculative. One patient received "graduated doses of auto-inoculation through auto-massage of his lungs." He rapidly improved. Favorable and fatal cases were studied and their charts compared. Isolated increments of temperature in otherwise declining phases were explained generally by auto-inoculation at such periods. This explanation is doubtless correct. It is questionable whether "hetero-inoculation" with tuberculin induces a rise of antitryptic activity in tuberculous subjects. It would seem that this depends largely upon the dosage. The chapter on autolysis is a very interesting resume. The book has brought forth nothing especially new along the prescribed lines. The confusion of certain terms is more apparent than real, for the previously mentioned coinage has served to elucidate matters. Otherwise, the subject has been very clearly stated and even though much of it is within the realms of speculation, it is one of the issues of today. W. T. C.

DISEASES OF THE NOSE, THROAT, AND EAR. By CHARLES HUNTOON KNIGHT, A.M., M.D., Professor of Laryngology in Cornell University Medical College, and W. SOHIER BRYANT, A.M., M.D., Senior Assistant Surgeon in the Aural Department of the New York Eye and Ear Infirmary. Second edition. Pp. 660; 239 illustrations. Philadelphia: P. Blakiston's Son & Co., 1909.

THIS is a second edition of Dr. Knight's volume on *Diseases of the Nose and Throat*, comprising 390 pages of the text, and an entirely new section on the ear, by Dr. Bryant, comprising the

remaining 219 pages of text. The usual general index is divided into separate indices for the nose, the pharynx, the larynx, and the ear, an arrangement in the reviewer's opinion more annoying to the reader than convenient.

As mentioned in the preface, Dr. Knight, in preparing this new edition, has made numerous minor changes throughout, the chief of which are to be found in the chapters on deviated septum of the nose and on diseases of the accessory sinuses. The illustrations of the entire chapters on the nose and throat are well selected, and some of them are original. We notice many familiar names, among them Schnitzler, Zuckerkandl, Hajek, Turner, Kriez, Bryan, and so on, and especially some of the admirable anatomical illustrations of Deaver, of Philadelphia. As the first edition of this work has already been reviewed in some detail in this JOURNAL, it merely remains to state that it has evidently been brought up to date of going to press, and thus maintains its excellent repute. Dr. Bryant's chapters on the ear present considerable originality. Each chapter is followed by a list of his own journal and other articles on the subjects discussed. He begins with the anatomy, development, comparative anatomy, and embryology of the ear. All this is beautifully, copiously, and instructively illustrated by numerous original drawings, and several ingenious series of diagrams. Indeed, we noted but two selected illustrations in the whole section on the ear; one, Oppenheimer's diagram of a mastoid operation when the bone involvement required exposure of the sigmoid sinus or the middle fossa of the skull; and the other, Whiting's illustration of a mastoid bandage applied so as so pass wholly above the sound ear. The first chapter is followed with chapters on physiology; theory of sound perception and allied topics; general pathology; the flora and fauna of the ear; etiology of ear affections; examination of patients and diagnosis, and succinct succeeding chapters on diseases, therapeutics, treatment, and surgical technique. The anatomical, biological, physical, physiological, and physio-pathological portions of the text are exceedingly interesting, and are treated largely in an original manner. They are sufficiently elaborate, some of them markedly so; but the text devoted to diseases proper is concise almost everywhere, and in most instances quite paragraphic, with the exception of the surgical technique in mastoid surgery, which is in sufficient detail to be very satisfactory, and is likewise admirably illustrated. Here attention is attracted to the author's modified mastoid operation, which leaves the ossicles in position when their condition justifies preservation. Under the caption special local therapeutics a number of formulas are presented for antiseptic, anesthetic, digestant, sterilizant, and other purposes. The final chapter describes numbers of special otological instruments, with illustrations of many of them, and a few diagrams of the manner and method of their usage.

J. S. C.

SHORT TALKS WITH YOUNG MOTHERS ON THE MANAGEMENT OF INFANTS AND YOUNG CHILDREN. By CHARLES GILMORE KERLEY, M.D., Professor of Diseases of Children in the New York Polyclinic Medical School and Hospital. Second edition; pp. 327; 21 illustrations. New York: G. P. Putnam's Sons, 1909.

THE ever-increasing appreciation on the part of the laity of the value of preventive medicine is in no way better shown than in the desire of intelligent mothers to learn how properly to care for their children. This modern demand for accurate knowledge has created a field of usefulness for such a book as Dr. Kerley's, the second edition of which has recently been published. In this compact volume the author explains briefly and clearly the best recognized scientific facts bearing upon the care and management of the child from its earliest infancy, both in health and disease. In so doing he dispels many of the traditional fallacies frequently adhered to by many a young mother. After describing the well baby and the necessary preparations that should be made for its reception into a household, he proceeds to devote nearly one-third of the book to a consideration of the all-important question of feeding. The section on "modified" or, as the author prefers to term it, "adapted," milk is an unusually clear, concise account of an ordinarily obscure subject. The author is to be further commended for having considered in detail diets suitable for children from one to six years of age. The frequency with which this phase of the feeding problem is neglected has resulted in widespread ignorance and indiscretions in the feeding of children after the first year. In addition to a careful consideration of the proper bathing, clothing, and exercising of the child, the remainder of the book comprises largely a series of brief descriptions of the more usual diseases of childhood. The attention paid to the serious complications of the acute infections conveys to the reader a true appreciation of their gravity; but the author wisely follows the rule of avoiding all suggestions relative to medical treatment. The freedom of the work from unexplained technical terms, the number of helpful practical suggestions it contains, and the fact that it is so evidently based upon the actual experience of the author, which has been considerable, should entitle the latest edition of this book to the deserved popularity enjoyed by its predecessor.

G. M. P.

PROGRESS
OF
MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

WILLIAM OSLER, M.D.,

REGIUS PROFESSOR OF MEDICINE, OXFORD UNIVERSITY, ENGLAND,

AND

W. S. THAYER, M.D.,

PROFESSOR OF CLINICAL MEDICINE, JOHNS HOPKINS UNIVERSITY, BALTIMORE, MARYLAND.

The Association of Aortic Insufficiency with Syphilitic Aortitis.—LONGCOPE (*Jour. Amer. Med. Assoc.*, 1910, liv, 118) reports twenty-one cases of aortic endocarditis associated with that type of mesaortitis, which is considered to be of syphilitic origin. All but three of these cases presented definite signs of aortic insufficiency during life. Seventeen of the patients were under fifty years of age, and in eleven a definite history of syphilis was obtained, or gummas were found at autopsy. A history of rheumatic fever was conspicious by its absence. In seventy-six other cases of chronic aortic endocarditis, twenty-one, which showed lesions of other valves as well, and were for the most part almost certainly of rheumatic origin, had smooth, delicate aortas. In the other thirty-four cases, 66.6 per cent. of which were over fifty years of age, the chronic aortic endocarditis was in most instances associated with an arteriosclerotic process in the aorta, but not a true mesaortitis. In only four or 11.9 per cent. of these cases were signs of aortic insufficiency present during life. In all, of forty-three cases of true aortic insufficiency giving symptoms, eighteen or 41.8 per cent. were associated with mesaortitis, and of twenty-two cases of aortic insufficiency uncombined with lesions of any of the other valves, eighteen or 81.5 per cent. were associated with mesaortitis. From a therapeutic point of view the realization that so large a proportion of cases of pure aortic insufficiency are of syphilitic origin is of the utmost importance.

Dextrose Consumption by the Heart.—Inasmuch as previous investigations as to the consumption of dextrose by the heart have given variable results, STEWART (*Jour. Exp. Med.*, 1909, xii, 59) has studied the

question in the isolated, perfused hearts of cats, and also of man. The perfusion apparatus used was that of Locke and Rosenheim—an arrangement by which a continuous circulation of fluid is kept up by means of oxygen pressure, so that the heart may be kept beating for many hours on a moderate amount of perfusion fluid. The quantity of dextrose in the fluid at the end of the experiment was compared with that at the beginning. The cat's hearts showed a consumption of dextrose proportional to the duration of the experiment and the weight of the heart. This amounted to 1.8 mg. of dextrose per gram weight per hour in freshly isolated hearts, and 1.3 mg. in hearts isolated two and a half hours after death. One human heart—that of a woman aged forty-six years,—was perfused at about two and a half hours after death. During the two hours over which the experiment was continued, 535 grams of dextrose were consumed, an amount equalling 0.07 mg. per gram weight per hour.

An Epidemic of Paratyphoid Fever Caused by a "Carrier."—SACQUEPEE and BELLOT (*Progrès médicale*, 1910, No. 3, 25) report an epidemic of paratyphoid fever occurring in a garrison of 250 soldiers. In the course of eight days, nineteen men became sick. The majority of the cases were typical, and ran a mild course, but a rather unusual feature was the prominence of meningeal symptoms—headache, Kernig's sign, stiff neck, and Babinski's sign. There were no fatal cases. Blood cultures were made in eight instances and in seven of these Bacillus paratyphosus β was isolated. The same organism was obtained from the stools in ten cases, and from the urine in two. The agglutination test was positive in dilutions varying from 1:350 to 1:900 with bacillus paratyphosus β, but was negative even in dilutions of 1:50 and 1.30 with Bacillus typhosus, and Bacillus paratyphosus α. Both food and water could be ruled out as possible sources of the infection, and it was then found that one of the cooks had suffered from a mild gastric upset, with headache, anorexia, and vague pains, several days before the epidemic began. In spite of his indisposition, however, he continued his work. Bacteriological examinations of his stools somewhat over two months after the onset of the epidemic showed the presence of Bacillus paratyphosus β. Similar results were obtained at intervals later. His blood serum agglutinated the Bacillus paratyphosus β in dilutions of 1:80, but failed to agglutinate typhoid or paratyphoid α at 1:20. The authors consider that the cook had passed through a mild, unrecognized attack of paratyphoid fever, during which he had infected the men whose food he handled.

Purpura Hæmorrhagica Due to Benzol Poisoning.—SELLING (*Johns Hopkins Hosp. Bull.*, 1910, xxi, 33) has studied a series of seven cases of purpura hemorrhagica occurring in workers in a factory of tin cans, and apparently resulting from the use of a substitute for solder, which contained benzol. Two of the cases were severe, and proved rapidly fatal. The most remarkable feature was the blood picture, which was that of an aplastic anemia. The red cells showed only slight pallor and anisocytosis. Nucleated red cells were practically absent. The platelets were markedly diminished in number. There was a relative increase in mononuclear leukocytes, associated with an extreme leuko-

penia which reached, in one instance, 140 cells per c.mm. A series of similar cases was reported by Santesson, of Stockholm, in 1897. In these the etiological factor was benzol, which was used as a solvent for rubber. The injection of benzol, as well as of chemically pure benzene, into rabbits caused aplasia of the bone-marrow, and marked leukopenia, with only moderate action on the red cells. Other workers with benzol have reported the presence of hemorrhages following experimental injection.

Intermittent Hydrarthrosis.—Up to the present contribution, the literature contained reports of about seventy cases of recurrent effusion into joints, with little or no febrile disturbance, and no local signs of inflammation, the so-called intermittent hydrarthrosis. Examples of this disease fall into one of two main groups—the primary cases which come on without definite cause, and in which the joints recover completely in the intervals, and the symptomatic cases in which the joints have been more or less severely damaged by antecedent disease. While the majority of instances described hitherto fall into the former class, five of the eight reported by GARROD (*Quarterly Jour. Med.*, 1910, iii, 207) are of the symptomatic type. With Schlesinger, Garrod regards the condition as akin to the acute circumscribed œdema of Quincke, and cites other instances showing the relation of certain transient articular lesions to cutaneous lesions of the erythema group, that is, Henoch's purpura, erythema nodosum, the rashes of rheumatic fever. Moreover, circumscribed œdema sometimes exhibits periodicity, and certain angioneurotic disturbances met with in it have also been found in association with intermittent hydrarthrosis. In several cases already on record, the two conditions were associated in the same patient, and in one of Garrod's cases, effusion into knee and wrist joints was accompanied by recurring œdema of the eyelids. In two other cases there are charts showing remarkable regularity in the length of both attacks and intervals over periods of six and fourteen months respectively. In all cases met with by Garrod, either one or both knees were affected alone or in connection with other joints. Of concurrent conditions, pregnancy exercises the most influence on the course of intermittent hydrarthrosis. In almost every case in which pregnancy has intervened, the articular attacks have stopped during that period.

Experiments on Secretory Gastric Stimulants.—Pavlov, as is well known has shown that the secretory function of the gastric glands is dependent on two factors, a so-called "psychic" or "reflex" stimulus carried through the central nervous system, and excited by the sight, taste, or smell of food, and a so-called "chemical" stimulus due to the action of various chemical substances through the blood, substances found and existing pre-formed in the food, as in the case of various salts and extractives, or resulting from the decomposition of various albuminous bodies. BOLDIREV (*Russkyi Vrach*, 1910, etc.) has studied the relative stimulating effect on the gastric glands of decoctions of six kinds of fish, hare, beef, and chicken, and a solution of Liebig's extract, employing dogs with gastric fistulæ prepared according to Pavlov. Equal quantities of fish or meat broths respectively were introduced into the stomachs at a temperature of 38° C., care being taken to eliminate all psychic

factors. Comparing the action of fish broth, beef bouillon, and Liebig's extract, it was found that fish broth possessed the highest stimulating power on gastric secretion. Control experiments showed that the action was not due to salts or extractives in the broth, but to certain specific qualities of the fish broth. This activating power of fish broth varies for different finds of fish—the broth made from the "chub" being the strongest, exceeding that induced by the same amount of beef bouillon both in quantity and in duration of its secretion. The pepsin content was slightly less per c.c., but increased absolutely in proportion, being as 96:99. The acidity in the case of fish broth was 4.5; in the case of beef bouillon, 3.8. A repetition of the experiment through many days failed to lessen the secretory activity of the stomach through a summation of stimuli as in the case of "psychic" stimulants; on the contrary, such repeated introductions of the broth heightened the irritability of the gastric mucosa, stimulating it even to more copious secretion. The author, therefore, suggests that in fish broths we may have an excellent stimulant to gastric secretion which does not lose its effect through its repeated use, and may, therefore, be of practical value.

The Action of Mercury on the Complex Hemolysis of Immune Serums and on the Wassermann Reaction.—EPSTEIN and PRIBRAM (*Ztschr. f. exp. Path. u. Therap.*, 1909, vii, 549) find that small quantities of mercury accelerate and accentuate immune serum hemolysis in vitro, so that possible fixation of complement may be missed. They next attempted to reproduce the reaction in vivo. A rabbit was selected whose serum possessed the property, similar to that of luetic serum, of inhibiting hemolysis by the immune serum of a sheep, when treated previously with the alcoholic extract of a guinea-pig's heart. They found that the corrosive sublimate, which was injected subcutaneously, appeared in the blood of the rabbit in sufficient strength to inhibit complement fixation. The experiment seems to indicate that caution must be exercised in interpreting the disappearance of a previously positive Wassermann reaction in a patient under mercurial treatment. The disappearance of the reaction does not mean a cure necessarily; it may be due simply to the fact that enough mercury is circulating in the patient's blood to inhibit the reaction.

Studies on the Physiologically Active Substance of the Thyroid Gland.—Since the experimental studies of the action of the thyroid gland and its products are based largely on surgical removal of the thyroid and the parathyroids as well, thus complicating the symptoms and making deductions unreliable, PICK and PINELES (*Ztschr. f. exp. Path. u. Therap.*, 1909, vii, 518) have re-investigated the subject. For their experiments they have used young goats, since it has been shown that in this animal the thyroid gland can be removed with comparative ease without injury to the parathyroids; furthermore, the clinical picture of myxœdema is well marked in the goat, especially when the gland is removed early in life. The thyroid glands used in the treatment of the thyroidectomized goats were obtained fresh from hogs. The authors have studied the therapeutic effect of the following substances: thyroid gland; iodothyrin; thyreoglobulin; thyreoproteid; the products of peptic and tryptic digestion of the thyroid gland, including primary

and secondary albumoses and further cleavage products, obtained separately. They find that thyroid gland and thyreoglobulin have a marked and rapidly beneficial action. Secondary albumoses derived from hydrolysis of the thyroid are also active, but apparently less so than the former substances. Thyreoproteid, iodothyrin, and the less complex products of digestion of the thyroid were wholly inert. Their experiments offer no ground for the supposition that iodothyrin is the active constituent of the gland, or even that it is one of the active constituents. The authors believe, apparently, that iodothyrin is capable of stimulating the thyroid gland to increased activity and are inclined to attribute the favorable results in myxœdema reported in literature to stimulation of the gland itself, a part of which they assume has persisted, but is functionally insufficient.

Disinfection of the Skin with Tincture of Iodine.—UNGER (*Berlin. klin. Woch.*, 1910, xlvii, 63) has tested the method of skin disinfection proposed by Grossich with good results. The field of operation is painted with tincture of iodine (10 per cent. to 12 per cent.), and after a few minutes (drying) it is repainted till the skin has the dark color of a negro. After operation the line of stitches is again painted. Better results are obtained when previous washing of the skin is omitted, the author says, the skin being shaved dry, when necessary. Numerous laparotomies have been performed after employing this technique with uniformly good results. The method should be valuable to the general practitioner in minor operations, such as pleural aspirations, infusions, etc., because of its simplicity and rapidity.

Bile Acids as a Cathartic.—GLAESSNER and SINGER (*Wien. klin. Woch.*, 1910, xxiii, 5) have discovered that bile administered per rectum leads to prompt evacuation of the bowels. The action has been studied in detail in dogs, and it has been found that the peristalsis is set up chiefly in the large intestine. Bile acids are the active constituent of the bile. Cholic acid acts most powerfully, though taurocholic and glycocholic acids also cause active peristaltic movements. Because of its expense, the extensive use of cholic acid is precluded. "Platner's" bile has been found to be a suitable substitute, given in doses of 0.2 to 0.5 gram. As a rule, the patient has a stool in five to fifteen minutes after administration per rectum. The stool is formed, with no excess of fluid. The results have been especially gratifying in paralytic ileus, in post-operative and peritonitic intestinal paresis, and in atonic conditions of the large bowel.

The Lungs and Trauma.—KÜLBS (*Archiv f. exp. Path. u. Pharmakol.*, 1909, lxii, 39) reports the pulmonary effects of trauma of the chest in dogs. In addition to pleural wounds, rather extensive lesions of the lung occurred. The usual finding was hemorrhage. The skin was often intact. At times the hemorrhage involved an entire lobe. Infection of the hemorrhagic area was not observed. That similar lesions occur in man as a consequence of blows with blunt instruments is quite possible, though conclusions cannot be drawn safely in this instance from the results of animal experiments. However, pneumonia following trauma occurs occasionally in man. It is probable that the immediate effect of

trauma in man and the dog is identical. In man, the liability to infection of the hemorrhagic zone is much greater. The pneumonia develops gradually, usually several days subsequent to the traumatism, probably from progressive extension of the bacterial infection.

SURGERY.

UNDER THE CHARGE OF

J. WILLIAM WHITE, M.D.,

JOHN RHEA BARTON PROFESSOR OF SURGERY IN THE UNIVERSITY OF PENNSYLVANIA; SURGEON TO THE UNIVERSITY HOSPITAL,

AND

T. TURNER THOMAS, M.D.,

ASSOCIATE IN SURGERY IN THE UNIVERSITY OF PENNSYLVANIA; SURGEON TO THE PHILADELPHIA GENERAL HOSPITAL, AND ASSISTANT SURGEON TO THE UNIVERSITY HOSPITAL.

The Etiology of Appendicitis.—MacLean (*Mitt. a. d. Grenzgeb. d. Med. u. Chir.*, 1909, xxi, 36) investigated the causes of appendicitis among soldiers and sailors, and restricted the investigation to the importance of a simple, infectious intestinal catarrh, intestinal worms, influenza, the mode of life, and the nourishment taken. A large number of cases of intestinal catarrh and dysentery were observed by MacLean in China, and he concludes that appendicitis occurs very rarely in these conditions. Nor does there seem to exist any special causal relation between typhus and appendicitis, or between the presence of intestinal worms and appendicitis. Likewise as between influenza and appendicitis, a causal relation can be excluded. The Chinese enjoy a rare immunity from appendicitis, which is regarded as the offspring of European culture. It has its essential cause in the different modes of life of cultured and uncultured people. When this difference in living between the people of nations free of appendicitis and those among whom it is common and increasing is investigated, it is found that it must lie in the difference in nourishment. It lies probably in the difference in the consumption of meat, which is greater among Western people than those of the East, greater among city people than country people, and greater today than one hundred years ago. It is generally known that appendicitis is a disease of the well-to-do, who eat more meat than the poorer people. Constipation is almost a national condition in Germany, England, and America. In China, except in opium smokers constipation is rare, which is also true of country people in general. The constipation associated with a meat diet disappears as soon as the physician enforces a vigorous vegetable diet. Mucous colitis is very frequent in the meat eating countries, but is very rare in the Chinese, colored people, and those who live in the country. MacLean has never seen it among the Chinese. It is well known that constipation, mucous colitis, and appendicitis are frequently associated. They should be

looked upon as the results of a predominating meat diet. This theory of chronic irritation of the lower bowel and its relation to appendicitis, explains some questions, previously unexplained. The infrequency of appendicitis in infants and young children is due chiefly to the fact that they are not meat eaters. Whatever preponderance of appendicitis occurs among military men is due to the fact that in the service, they eat more meat than at home. Men have the disease more frequently than women for the same reason, and the occurrence of the disease in several members of the same family, is to be explained by the fact that they all partake of the same excess of meat. In MacLean's opinion, therefore, an excessive meat diet is the underlying cause of appendicitis.

The Causation of Perforating Ulcer of the Foot.—Levy (*Mitt. a. d. Grenzgeb. d. Med. u. Chir.*, 1909, xxi, 85) is inclined to view every genuine perforating ulcer as the result of a central nervous disturbance, since it is exceedingly difficult, probably impossible, in a multiple neuritis to exclude a central disease. Probably many cases reported in past years, of "perforating ulcer in neuritis," were in reality due to an unrecognized tabes. In the 12 patients presenting 14 perforating ulcers of the foot, typical arthopathies were present. The joints and bones participated in the process, with the exception of one case in which there was a spontaneous fracture. In one case of chronic ulceration of the toe in syringomyelia, no bone changes were manifest. The ulcer showed no signs, microscopically, of tuberculosis. In general, every chronic ulceration with simultaneous disease of the nervous system, should not be considered, a priori, as a perforating ulcer. The changes in the bones and the joint in Levy's cases were regarded as the primary condition, the perforating ulcer as a secondary result. Mechanical insults play only a predisposing role, and not a purely causal one. An exact clinical and *x*-ray examination should be made in all cases of perforating ulcer, and should determine the existence of these changes (arthropathies, synovial effusion, spontaneous fracture). When surgery is called upon as a therapeutic measure, the primarily diseased portions of the bones, which are the underlying cause of the perforating ulcer, should be removed.

Acute Primary Typhlitis.—Röpke (*Archiv f. klin. Chir.*, 1909, xcix, 160) says that in the whole literature of acute inflammations of the right iliac fossa, cases of acute primary typhlitis are met with only very rarely. Many internists have denied the occurrence of this condition, while others admit that it does occur occasionally. Röpke reports four cases which were operated on for appendicitis and the diagnosis thus made. In one case in which there had been previous similar attacks, there was found to be a total obliteration of the appendix, which was probably due to the previous occurrences of appendicitis. The similarly of all attacks and particularly the occurrence with every attack of a troublesome diarrhœa, gives reason for the opinion that each attack of appendicitis had set up a severe inflammation of the cæcum, especially as the appendix was free of adhesions. The inflammatory process in the right iliac fossa takes its origin in the great majority of cases from the appendix, but in rare cases it may come alone from the cæcum. A stercoral typhlitis cannot be demonstrated with certainty. The typhlitis may be caused

by infection from the intestinal contents or by way of the blood or lymph paths. A sharp distinction cannot be made between typhlitis and appendicitis, the clinical symptoms of both being the same throughout. The treatment of acute typhlitis is essentially the same as for appendicitis. The appendix should be removed at every operation, even if it appears to be normal.

Radical Operation for Non-incarcerated Hernia.—IMFELD (*Deut. Ztschr. f. Chir.*, 1909, ciii, 57) makes a report on 454 hernias operated on in Kocher's clinic in Bern. There were 342 indirect and 24 direct inguinal, 38 femoral, 25 umbilical, 21 epigastric, and 4 ventral. The indirect inguinal hernia were operated on by four different methods. In most of the cases the invagination-displacement method of Kocher was employed. Here and there the lateral displacement method of Kocher, without invagination was performed. For those cases not suited to either of these methods, the so-called "old method" was done, and it was also used in children. It consisted in isolating and ligating the sac and then placing it in a high position, the canal then being sutured. Here and there the Bassini method was employed, but only in very rare cases was it the pure Bassini method. In the umbilical, epigastric and ventral hernias, the sac was removed and the ring closed. Two patients died, a mortality of 0.44 per cent. In most cases a hematoma developed, which was left alone, punctured and aspirated, or cleaned out. In 4 cases there was suppuration and healing by granulation, in all others by first intention. The best end results in the indirect inguinal hernias, were obtained by the invagination—displacement method, *i.e.*, 25.2 per cent. of permanent cures. In the femoral this method showed 94.45 per cent. of permanent cures. It was employed in only 3 direct inguinal hernias, and of these, 2 recurred, 33.3 per cent. of cures. With this method Hirschkopf operated on 83 cases and obtained 98.8 per cent. of permanent cures; Daiches, in 90 cases, obtained 96.7 per cent.; and Imfeld, in 247 cases in his series, obtained only 94.4 per cent. These poorer results are explained as follows: Two of the recurrences were in direct inguinal hernias, which are especially unsuited to this method; many of the operations were performed by assistants; the hernias in which there was no hernial sac were excluded from the series and these give the best results; and finally, Hirschkopf's reports concerned the cases, one to two years after operation, Daiches' five years after, and Imfeld's five to eight years after operation.

The Treatment of Fracture-dislocations of the Spine with Compression.—ROBERTSON (*Deut. Ztschr. f. Chir.*, 1909, ciii, 179) says that in every fracture of the body of a vertebra with compression of the cord by the bone, in which the diagnosis is established by the *x*-rays, a careful operation is necessary. The operation should aim to expose freely the site of the compression. A laminectomy alone is not sufficient, but the bone on the posterior surface of the wounded body must be excised to obtain positive results. The pairs of nerves immediately above or below the dislocated vertebra should be divided in order to prevent as far as possible angulation of the spinal cord and the dura. A preliminary hemostasis should be obtained, not only to make the operation more easy, but also to prevent the accumulation of blood, which may interfere

with the blood supply of this region. Provisional sutures are introduced on either side of the proposed incision, which on being tied will control the bleeding in the soft tissues. Adrenalin injections are employed to control the bleeding from the dura in the bone. The loss of cerebrospinal fluid in the days following the operation is not important, and any disturbance which may result from its loss can be overcome hy hypodermoclysis. An effort should be made to provide immobility by a plaster cast, after operation, and even on the operation table.

The Treatment of Convulsions Following Orthopedic Operations.—SCHANZ (*Zentralbl. f. Chir.*, 1910, xxxvii, 43) says that occasionally, shortly after an orthopedic operation, epileptiform convulsions occur, and sometimes prove fatal. They may occur on the same day or several days after the operation. Before the convulsion the patient may be apathetic, complain of severe headache, or be very cheerful. Frequently there is a sharp rise of temperature, at the beginning of the convulsion, which does not depend upon an infection. The convulsion is so similar to the epileptic type that they are frequently confused, and the relation between the convulsion and the operation is not suspected until a series of convulsions have taken place. The course of the cases vary. Of about 10 cases seen by Schanz, 1 died, 1 developed hemiplegia, and all the others recovered. Von Aberle has shown that the convulsions are due to fat emboli. Before he knew the cause of the convulsions, Schanz had employed subcutaneous saline infusions in the treatment and he regards the effects as evidently favorable; more favorable the earlier and the more abundantly they are given. He believes that the effect of the saline solution is to dilate and flush the capillaries in which the fat droplets are lodged, tending to thin out the fat emulsion and to force it onward. The rule in his clinic is to give immediately one-half to 1 liter of the saline solution, in different places. In a very severe case threatening the life of the patient, he would give the infusion intravenously.

A Contribution to the Operative Treatment of Epilepsy.—E. BIRCHER (*Zentralbl. f. Chir.*, 1910, xxxvii, 5) after referring to the report of Krause on the results of excision of the brain centres controlling the convulsions, calls attention to the method of treatment employed by H. Bircher. This method is more simple and Bircher believes as effective as the Krause excision. The part of the brain involved is exposed freely by an osteoplastic flap. The dura will be found under strong tension, especially, in cases of genuine epilepsy, as Kocher and more recently Friederich and Krause have shown. The dura is then carefully opened, preferably, with a crucial incision, and the brain exposed. Now follows the important procedure of massaging the exposed brain surface. This is best done with the thumb, for three to five minutes, covers all the cortex in the opening, and has no regard for the pia mater. The dura is then closed or a drainage opening is left. It is absolutely necessary to open the dura, otherwise the desired result will not be obtained, as was shown after two operations on one case, in which after the third operation and the opening of the dura the attacks slowly disappeared and have been absent for four and one-half years. In three other cases the cure has lasted two and one-half, two, and one-half

a year. The effect of this treatment on the brain was shown in a case which came to autopsy eight weeks after operation. For four years the attacks had been increasing in frequency and severity and the patient would remain unconscious for several days at a time. Because of the marked brain pressure at the time of operation, the bone covering the opening was removed. Primary healing occurred. For two months there was no convulsion and then more severe attack than usual occurred. The patient died four days later in status epilepticus. The autopsy showed excessive tension of the dura and the ventricles were slightly enlarged. At the site of operation the healing was faultless with no dural adhesions. The whole circumference of the massaged surface of the brain could be mapped out. Its color was whitish, in contrast to the gray cortex, and the surface was sunken below that of the surrounding parts. A vertical section of the brain was made and it was seen that the massaged surface was reduced in thickness to about one-fourth of the normal. In the centre of this area the cortex had completely disappeared. Bircher thought that in this case death was due rather to an associated valvular disease of the heart than to the epilepsy. He believes that the massage brings about a gradual atrophy of the gray matter of the cortex and that it therefore produces the same result as excision of the cortex, without the motor and sensory paralysis which immediately follow excision.

Ureteral Calculi.—JEANBRAU (*Ann. de. m. d. org. gén.-urin.*, 1910, i, 1 and 132), in an extensive paper on this subject, takes up the history, pathological anatomy, clinical aspect, diagnosis, skiagraphy, and therapy. He sums up the clinical picture according to the site of the calculus. (1) The functional symptoms in lumbar and iliac calculi and those of the upper part of the pelvic ureter are as follows: predominance of symptoms of a renal character; nephritic colic without results but with pain radiating down the ureter, or vice versa; spontaneous pain along a certain extent of the ureter after the crisis, persisting indefinitely with exacerbations due to movement, indigestion, etc.; microscopic hematuria after the crisis; and rarely vesical symptoms. (2) Functional symptoms of juxtavesical ureteral calculi; nephritic colic without results, and ureteral crises; pelvic pain, continuous or intermittent; vesical, seminal, testicular and rectal symptoms (Young). (3) Functional symptoms of ureteral and intravesical calculi: vesical symptoms, simulating a calculus of the bladder with pain at the end of the penis, burning upon micturition, dysuria, sudden arrest of the stream, polyuria on movement; seminal and testicular symptoms; nephritic colic without results and ureteral crises when the calculus obstructs the meatus; these symptoms are especially marked when there is an intravesical prolapse of the ureteral mucosa. When the calculus becomes blocked and immovable in the ureter, it increases progressively by crystalization upon its surface of urates, oxalates, or phosphates, and leads more or less rapidly to destruction of the kidney by pyonephrosis, by urenephrosis, vesical sclerosis and atrophy, periureteritis with ulceration, perforation of the ureter, perinephritic phlegmon and ureteral fistula, through which the calculus may be eliminated. Every calculus arrested in the kidney, proceeds to the complete destruction of the kidney which forms it. At the same time it prepares the anuria for the time when the ureter

will become obliterated. The ureter may be explored by palpation to find the painful area; and the calculus may be felt through the abdominal wall, by the vagina or rectum. The appearance of the ureteral meatus may lead one to suspect the existence of calculus higher up in the ureter, as has been hown by Fenwick and corroborated by Klotz. Exploration of the ureter by the ureteral catheter with a wax tip, will often show scratch marks on the wax when a stone is present. At times the catheter will pass the stone without receiving such marks. The *x*-rays have reduced considerably the indications for this method of diagnosis. In 64 out of 68 cases, the *x*-rays gave a shadow of the calculus. All calculi too large to pass spontaneously will give a skiagraph shadow, with some exceptions that remain to be studied. The causes of non-visibility of the stone are: (1) Faulty technique; (2) the chemical constitution of the stone; and (3) its small size. The chemical constitution plays the most important role. The stone may be removed by the superior orifice of the ureter after a nephrotomy or pyelotomy, by the inferior orifice after a cystotomy, or by incision of the ureter, uretero-lithotomy. Nephrotomy is indicated only when there is a period of anuria and when there coexists a stone in the kidney. Pyelotomy permits easy extraction if the pelvis is accessible and it is dilated. Extraperitoneal uretero-lithotomy is the operation of choice. When the patients are not anuric and have sufficient resistance not to succumb to the anæsthetic, uretero-lithotomy gives a mortality of 1.16 per cent. In 10 cases operated on in a period of anuria it gave 6 deaths, or a mortality of 60 per cent. Fistula formation will be avoided if the permeability of the ureter in its whole extent can be established after the removal of the calculus.

THERAPEUTICS.

UNDER THE CHARGE OF

SAMUEL W. LAMBERT, M.D.,

PROFESSOR OF APPLIED THERAPEUTICS IN THE COLLEGE OF PHYSICIANS AND SURGEONS, COLUMBIA UNIVERSITY, NEW YORK.

The General Principles of Vaccine Therapy.—RICHARDSON (*Jour. Amer. Med. Assoc.*, 1910, liv, 255) points out the fact that in vaccine therapy the aim is the production of an active immunity. Therefore, success in this method of treatment presupposes that the patient is not already completely overwhelmed by the infection. Furthermore, if this procedure is to bring about, as it should, increased bacterial destruction, with the setting free thereby of an increased amount of endotoxin, this destruction must not be too rapid or excessive lest efforts to cure do harm through hyperintoxication. Bacterial immunity is brought about through the action of a great variety of different though related immune substances, and as a result of inoculation with vaccines there may be formed antitoxins, anti-endotoxins, lysins, agglutinins,

precipitins, opsonins, and other allied products. By bacterial vaccine is generally meant a culture of the special organism sterilized by heat, or otherwise, and suspended in known proportions in normal salt solution. Living organisms, attenuated either in number or virulence, have also been used. In this connection Richardson mentions the work of Strong, who inoculated plague bacilli of attenuated virulence in order to produce a stronger immunity. Living typhoid bacilli and tubercle bacilli have also been used and favorable results have been reported. Richardson says that autogenous vaccines are preferable to stock cultures. No definite rules can be laid down as to dosage. It is advisable to begin well below what is considered the ordinary dose and gradually to increase. The interval between doses will vary in different infections. The author calls attention to the inoculation against typhoid fever of large numbers of troops in the British Army, as reported by Leishman. Of 5473 soldiers inoculated, only 21 were subsequently infected, with 2 deaths, while of 6610 non-inoculated in the same regiment, 187 had typhoid and 26 died. The experience of the Germans, while not so extensive, confirms these results. Chantemesse and his colleagues used a serum treatment of typhoid fever in 1000 cases, with a death rate of 4.3 per cent. Of 5621 patients who were given routine treatment during the same time, 17 per cent. died. The nature of Chantemesse's serum is not understood, though he claims antitoxic properties for it. Richardson says that there can be little doubt that infections of the urinary tract due to the colon bacillus are favorably affected by vaccine treatment. Vaccines have also been used with favorable results in the treatment of gall-bladder fistula and in cases of appendicitis where pure cultures of colon bacilli were obtained.

Subcutaneous Purgatives; a Clinical Study on Phenoltetrachlorphthalein.—Rowntree (*Johns Hopkins Hospital Bull.*, 1909, ccxxii, 293) reports his results with the subcutaneous administration of phenoltetrachlorphthalein. He gave 0.4 gram dissolved in 20 c.c of oil hypodermically to patients suffering from chronic constipation. Ten out of twenty-five patients, after receiving one injection of this oil preparation, together with instructions as to diet, hygiene, and habit, have had no return of constipation. Rowntree gives the following disadvantages of the general adoption of phenoltetrachlorphthalein as a subcutaneous purgative: (1) The insolubility of the drug in water. (2) The slight degree of its solubility in oil, necessitating a large volume for injection. (3) The long time that elapses before the onset of purgation (eighteen to twenty-four hours). (4) The mild character of its action, which is laxative rather than purgative. The redeeming features are: (1) The prolonged nature of its action. (2) The absence of crampy pain and colic throughout the period of its action. (3) Its non-irritant action locally. (4) The constancy, at least in the cases so far studied, with which it has produced its result. (5) The non-toxicity of the drug. Rowntree says that it may prove of value: (1) In coma; (2) in marked gastro-intestinal irritability when nothing can be given by mouth; (3) among the insane, who often refuse to swallow medicine and who fight against enemas; (4) in chronic constipation, together with hygienic, dietetic, and pyschical treatment. Rowntree believes that it is worthy of a trial in the field of abdominal surgery, where its introduction under the skin

can be accomplished during the anesthesia without any pain whatever, and where its mild, prolonged, laxative effect, continuing for from four to six days, may possibly entirely dispense with the necessity of administering any purgative by the mouth during the first week subsequent to the operation.

Magnesium Poisoning.—Boas (*Bost. Med. and Surg. Jour.*, 1909, clxi, 122) believes that magnesium poisoning is probably more frequent than is generally supposed, the true cause of the toxic condition remaining unknown in most cases. Boas reports three cases, two of which were suspected merely because of the high specific gravity of the urine. The specific gravity in one of these cases was 1070; in the other it was 1080. These two cases recovered, but the third case died. Fraser reports a case of his own and discusses six other reported cases. Boas has made a careful study of the ten available cases, and in addition carried out experimental work in order to determine the conditions governing the absorption of Epsom salt solutions. He found that in the absence of hydremia the tendency of magnesium sulphate to be absorbed increases with the concentration of the solution, the dry salt being completely absorbed without action on the bowels. This fact was shown by Hay to be true also of Glauber's salt. In hydremic conditions, however, the salt, even when it is given in very concentrated solution, is not absorbed. It appears, therefore, that the practice of giving very concentrated solutions of magnesium sulphate to deplete the system of excessive water is rational, but perhaps not without possible danger. In the absence of œdema or ascites, the object of giving magnesium sulphate can be none other than to produce efficient catharsis. To attain this object without the danger of intoxication from absorption, the salt is best given in solutions not exceeding 6 per cent. in concentration. Above this concentration more or less magnesium sulphate is absorbed, and its presence in the circulation is a menace to the patient's life. As a result of Boas' investigations, the ward patients in the Massachusetts General Hospital are now given one-half ounce of Epsom salt dissolved in three ounces of water, to be followed immediately by a glass of water.

The Action of Strophanthin.—Crispolti (*Il Policlin.*, 1909, xvi, 248) has made numerous experiments with Merck's and also with Böhringer's strophanthin. He gives as dosage by the mouth 1 to 4 mg., and up to 4 mg. a day; by intramuscular injection, 1 mg. and up to 3 mg. a day; by intravenous injection, 0.25 to 1 mg., and up to 2 mg. a day. Strophanthin is very uncertain in its action when given by the mouth, according to Crispolti; small doses are without any effect, while larger doses rapidly produce symptoms of intolerance. These symptoms are headache, a sense of tightness in the chest and over the precordium, marked slowing of the pulse, at times a begeminal pulse, marked rise in the blood pressure, cardiac arrhythmia, insomnia, nausea, or vomiting. Such symptoms are less marked and more transient when strophanthin is given intravenously. Crispolti says that strophanthin is indicated in cases of heart failure with arrhythmia and low blood pressure, or in infective processes or myocarditis when the heart is giving out, and when an immediate effect is required. Given intravenously, strophanthin

should make the pulse slower, fuller, more regular; dyspnœa and cardiac oppression should be relieved, diuresis should set in, and the general conditions of the patient should improve markedly within a few hours. The dose should be 0.5 or 1 mg. in cases of severe heart failure; one injection a day is usually enough, but two may be given of 1 mg. each in bad cases. Four or five intravenous injections are usually sufficient. Intramuscular injections of from 0.5 to 1 mg. of strophanthin are indicated in the less severe cases of failure of compensation. Crispolti gives, as contra-indications to the use of strophanthin, high blood pressure and marked arteriosclerosis and acute or chronic nephritis.

The Intravenous Use of Strophanthin in Broken Cardiac Compensation.—STONE (*Bost. Med. and Surg. Jour.*, 1909, xvii, 586) says that in certain cases the intravenous use of strophanthin has a most favorable effect in restoring cardiac compensation. The immediate result is to increase the amplitude of the pulse wave. The frequency of the heart is at the same time slowed within a few minutes, almost, if not quite, as completely as can be accomplished by the administration of digitalis preparations by the mouth in the course of several days. This immediate relief will last from twelve to seventy-two hours, and in some cases even longer, and is usually accompanied by free diuresis, or will permit diuretics previously inert to become once more active. Stone points out the dangers in the intravenous use of strophanthin, and says they must not be underestimated. The therapeutic dose and the poisonous dose are near together, and as the elimination of the drug is slow, one can easily get toxic symptoms of slowed pulse and of heart block from too frequent administration. The previous administration of digitalis is an almost sure contra-indication to the use of strophanthin. Cases with marked renal disease do not respond favorably to the use of strophanthin. A high blood pressure is not a contra-indication, but marked bradycardia always is. Stone gives the strophanthin in doses of 1 mg., which dose should not be repeated within twenty-four hours unless in exceptional cases.

Clinical Experiences with Calcium Lactate in Hemorrhages of the Upper Air Tract.—SIMPSON (*Med. Record*, 1909, lxxvi, 505) writes favorably concerning the control of hemorrhage by the use of calcium lactate. His conclusions are as follows: (1) Clinical experience shows that calcium lactate has a controlling influence in hastening the coagulation of the blood. (2) Its efficacy is more marked in hemophilic cases in which the coagulation is delayed than in cases of normal coagulation time. (3) Before operation, especially on tonsils and adenoids, careful inquiry should be made relative to any hemophilic tendency. (4) In suspicious cases the coagulation period should be determined before operation. (5) It is questionable, if not positively contra-indicated, whether such operations should be undertaken in hemophilic cases other than under the most extreme urgency. (6) In all cases of operations for the removal of tonsils and adenoids, calcium lactate should be given for a period prior to and after the operation, both for its possible effect in diminishing the immediate hemorrhage and in preventing secondary surface hemorrhage. (7) Of the calcium salts, the lactate is more positive in its results, is more agreeable to administer, and is less irritating to the stomach.

A Contribution to the Cause of Pernicious Anemia.—BERGER and TSACHIYA (*Deut. Arch. f. klin. Med.*, 1909, xcvi, 252) extracted with ether the mucous membrane of the gastro-intestinal tract of cases of pernicious anemia after death and obtained a lipoid substance which in vitro as well as experimentally on animals had a marked hemolytic action. The controls made with normal mucous membrane showed only a slight hemolytic action. They then produced a catarrhal inflammation of the gastric mucous membrane of dogs. The ether extracts of the involved mucous membrane contained a similar lipoid body. From these experiments they draw the conclusion that the cause of pernicious anemia is a chronic catarrh of the mucous membrane of the gastro-intestinal tract and the consequent production of a hemolytic substance. They explain the beneficial effects of intestinal lavage and diet in pernicious anemia upon this same etiological hypothesis.

PEDIATRICS.

UNDER THE CHARGE OF

LOUIS STARR, M.D., AND THOMPSON S. WESTCOTT, M.D.,
OF PHILADELPHIA.

The Etiology of Epidemic Acute Anterior Poliomyelitis.—P. H. ROEMER (*Münch. med. Woch.*, 1909, lvi, 2505) discusses the work done by him in determining the cause of anterior poliomyelitis. Microscopic and culture examinations of the pharyngeal and tonsillar secretions were entirely resultless; the same was true of the examinations of the cerebrospinal fluid from six cases and of the brain and spinal cord of one child that died of the disease. Injections of the cerebrospinal fluid into mice, rabbits, and guinea-pigs remained negative; injections of an emulsion of the brain and spinal cord tissue into mice, guinea-pigs, and rabbits remained without result, but in the case of a monkey there occurred eight days after the operation a typical palsy and death. The histological examination of pieces of the nervous system of the monkey revealed typical changes of the disease. An emulsion made from the nervous tissues of this monkey and injected into rabbits produced no change, but when a monkey was used, the typical disease developed followed by death and changes typical of the disease. He concludes that the causal agent of epidemic acute anterior poliomyelitis most probably does not belong to a group of bacteria easily stained or cultivated—at least, it probably has never been either stained or cultivated. The virus is contained in the brain and spinal cord of individuals having the disease, and may be conveyed to monkeys by intracerebral inoculation. From cases of experimentally produced poliomyelitis in monkeys the virus can be conveyed to other monkeys by inoculation of brain or spinal cord emulsion. The possibility of an artificial cultivation of the virus in vivo is thus demonstrated.

Henoch's Purpura or Angioneurotic Œdema.—H. C. BARLOW (*Brit. med. Jour.*, 1910, i, 15) reports the case of a boy, aged twelve years, who with abdominal pain and diarrhœa, "the motions looking like blood," developed on both legs and hands white swellings the size of a walnut, which developed rapidly, lasted a few to twenty-four hours, and then disappeared. The bloody movements continued, the urine became bloody, and purpuric spots appeared, first over the elbows, later over other parts of the body. Improvement was followed by a return of symptoms in a similar routine; ultimately the boy recovered. A similar case is reported in a boy, aged four and one-half years. In this patient the condition lasted two months before convalescence became permanent. In neither case was the spleen palpable. In the first patient there was a slight elevation of temperature, and in both the pulse became slow and intermittent. In the second patient the joints were slightly involved. From being *in extremis* on one day, the second boy would return to apparently slight illness on the next. The best explanation for the illness, in the author's opinion, is a toxemia acting mainly on the sympathetic nervous system.

The Occurrence of Remissions and Recovery in Tuberculous Meningitis.—The study of 797 cases of tuberculous meningitis occurring in seven London Hospitals since the year 1897, and of which 17 (2 per cent.), recovered, as well as a thorough study of such cases in the literature, have led A. E. MARTIN (*Brain*, 1909, xxxii, 209) to draw the following conclusions: (1) Undoubtedly long remissions and even recoveries do occur in tuberculous meningitis. (2) Recoveries are possibly more frequent than has been believed, since no fewer than twenty undoubted cases have been recorded since 1894, while other cases of recoveries have been reported in which the same definite proof of the nature of the disease has not been afforded, but some of which probably were true cases of tuberculous meningitis. (3) In those cases either the resistance of the individual is so much greater than usual, that the disease is checked early in its course, or the virulence of the bacilli is so much less than usual, that the lesion in the meninges becomes localized and later undergoes a fibrous change. (4) The lesion in the meninges may at a later period form the focus of a fresh infection, which usually terminates fatally, and consequently the prognosis in those cases must be guarded. (5) No treatment up to the present has been discovered which has had any specific effect in promoting the favorable termination of the disease.

Fifty-three Operations for Cleft Palate.—C. HELBERG (*Berl. klin. Woch.*, 1909, xlvi, 1757) relates his experience with operations for cleft palate, of which he has performed 53. He favors the performance of the operation in infants, having operated as early as the fourth month in healthy children. All of his patients (100 per cent.) recovered, and 40 (75.5 per cent.) were perfectly cured of their affliction; in eight there are fistulas remaining; a further attempt will be made to close them; in 5 the conditions are hopeless. The operation is no more difficult in very young children, if instruments of proportionate size are employed, than in older ones, and the earlier the operation is performed, the more likely is the patient of having a perfect functional result. Concerning

the technique, the author employs Langenbeck's method, but performs the operation like J. Wolff in two sittings. The first time the flap is loosened, the second time it is freshened and sutured. The dangers of flap necrosis are less, as the soft tissues can accustom themselves to the new blood supply. The flaps become thicker and broader and suturing is thus made easier. Hemorrhage is very slight if the sutures are put in some days after the loosening process. He employs silk for the soft palate and silver wire for the hard palate.

Cerebral Hemorrhage in a Child.—G. GHETTI (*Gazetta degli Ospedali*, 1909, xxx, 913) reports a case of cerebral hemorrhage in a boy, aged ten years. The boy was a foundling; at the age of eight a suprapubic cystotomy was performed for a vesical calculus; at the age of nine he had a rheumatic facial paralysis, and later headache was complained of for a long period, leading to a diagnosis of chronic meningitis. Ever since the bladder operation he had had some cystitis, at times there being difficulty in urination. On the night in question he retired in his usual health, sleeping normally until near midnight, when he rose to void urine. Shortly afterward the noise he made in breathing awoke the children, who slept in the same bed. He was unconscious and had a well-marked right-sided hemiplegia, the arm being in a state of semi-contraction. On the left side there was clonic convulsive movements. The right upper eyelid was lower than the left; the pupil reacted to light, not to accommodation. There was no knee-jerk on the right side, but there was a Babinski; on the left the reverse state was noted. There was incontinence of feces and urine. The child never recovered consciousness, and died on the fifth day. The autopsy showed a large hemorrhage in the left ventricle extending from the frontal to almost the occipital lobe. There was neither tumor nor tubercle; all other viscera were normal. The cerebral arteries were in a state of diffuse endarteritis. Spirochæta pallida, in spite of close search, could not be found. The immediate cause of the hemorrhage was evidently the strain on urination, the bloodvessels being already diseased by a chronic degenerative process, probably syphilitic.

Enterectomy under Spinal Anesthesia in an Infant Seven Months Old; Recovery.—H. A. T. FAIRBANK and WILFRED VICKERS (*Lancet*, 1910, i, 364) report this case because of the rarity of recovery after enterectomy for irreducible intussusception in small infants, and also to emphasize the effect of spinal anesthesia on this type of case in children. There have been reported since 1906 but 3 or 4 successful cases of enterectomy in children under one year. The case in point was a female infant, aged seven months, with irreducible intussusception; temperature, 100°; pulse, 164; respirations, 36. A resection of the bowel was made, including the cecum, appendix, and a part of the colon. The operation was performed under spinal anesthesia, using Gray's stovaine, dextrin, and saline solution. A second injection of stovaine was given just before anastomosis was made, as the patient was beginning to show signs of shock—the effects of the first injection having begun to wear off. The authors believe that the spinal anesthesia saved the child's life, while chloroform anesthesia would have proved fatal. The toxic effects were reduced to a minimum

by using Gray's solution. Spinal anesthesia prevents shock from stimuli arising from the seat of the operation as long as the effects of the anesthetic continue. The pulse improved immediately after the injection. There was a more marked improvement of the condition after the second injection, which was given when the effects of the first injection began to wear off. The special advantage of this method is that it produces flaccidity of the bowel wall itself and facilitates reduction of the intussusception. Shock was conspicuous by its absence. Two other cases operated upon for the same condition showed similar results. Physiologically speaking, loss of tone in the muscular coats of the intestine is possible from high anesthesia. The child received three pints of saline solution daily by the rectum and subcutaneously for five days before nourishment was begun, with small doses of morphine. Spinal anesthesia cases show practically no shock. The Murphy button used in the operation passed in eighty-two hours. The toxic effects in spinal anesthesia are certainly less than with general anesthetics in desperate abdominal cases.

OBSTETRICS.

UNDER THE CHARGE OF

EDWARD P. DAVIS, A.M., M.D.,

PROFESSOR OF OBSTETRICS IN THE JEFFERSON MEDICAL COLLEGE, PHILADELPHIA.

The Influence of a Bloodless Condition of the Uterus in Promoting Involution.—LONGRIDGE (*Brit. Med. Jour.*, November 20, 1909) found upon investigation that in 150 primigravidæ, during the latter months of pregnancy, blood pressure rose at term 20 mm. of mercury. After labor a corresponding drop is found, but even this leaves considerable pressure in the circulation. It seems to him reasonable that blood forced into the uterine wall at a pressure of over 100 mm. of mercury, would open vessels which are held closed during uterine relaxation only by elasticity of the muscle bundles. Yet we see cases after normal labor in which the uterus is relaxed, but does not bleed. There must be, in his view, some other provision of nature to prevent hemorrhage after labor. This he finds in the fact that when the uterus has expelled the child, it sinks down into the pelvis, carrying with it the uterine arteries, thereby shortening the length of the vessels two or three times. This produces numerous sharp kinks and twists in the vessels, which prevent the rapid flow of blood from the uterus, and are safeguards against hemorrhage. Anything which prevents the descent of the uterus, as the overdistention of the urinary bladder, will favor the occurence of hemorrhage. He also calls attention to the fact that the healthy uterus loses half its weight in the first week by rapid autolysis. The mechanism of the circulation in the uterus is such that it is practically anemic after delivery, and is not continually flushed with an alkaline stream of blood. Autolysis of animal tissue takes place much more rapidly in an acid than in an alkaline medium. In order to test the correctness of

these observations, he examined puerperal patients for nitrogenous waste early in the puerperal period, examining the urine for creatinin. He found a marked rise about the end of the first week, which seemed to be the result of the retention of sarcolactic acid. Evidently the uterine muscle was undergoing rapid autolysis. He also refers to a case reported by Whitehead in the *British Medical Journal*, October 12, 1872. The patient was an anemic woman, who, after the birth of her last child, had postpartum hemorrhage. She did not have the ordinary lochia, but a discharge of a brown watery fluid, which persisted for two weeks without change in its appearance. Menstruation was never reëstablished, and on examination no trace of the uterus could be found; the entire organ had disappeared. This he explained by the rapid autolysis of the uterine muscle, from the pronounced anemia present, the acid condition of the uterus, and the absence of alkaline blood. Clinical observation has shown that patients are sometimes free from lochia with the exception of a slight mucoserous discharge. In these cases after the fifth or sixth day, a very slight reddish discharge has been noticed, which soon ceases. This probably occurred when the circulation of the uterus was reëstablished. It is quite possible for patients to pass through the puerperal period without lochial discharge and to have rapid and complete involution. In the case of other warm-blooded animals than human, recovery after parturition is not accompanied by the pretence of a lochial discharge.

Adrenalin in Pernicious Nausea of Pregnancy.—REBAUDI (*Zent. f. Gynäk.*, 1909, No. 44) narrates a case in Bossi's clinic at Genoa in which a primipara suffered from general indisposition, asthenia, melancholy, and depression. The patient had many symptoms of toxemia, headache, vasomotor disturbance, loss of appetite, impaired digestion, and excessive secretion of saliva. Pernicious nausea afterward developed. Various methods of treatment were unsuccessful, and the interruption of pregnancy was seriously considered. Before resorting to this the patient was fed by rectal injections, and 20 drops of 1 to 1000 adrenalin were given daily, 10 in the morning and 10 in the evening. During the first three days the patient also received by rectum a small quantity of water containing 20 drops of laudanum, and after that small doses of ice water. In about two days after beginning this treatment the vomiting, which had been practically continuous, ceased, and on the third day the patient took small quantities of cold food. The symptoms had so largely disappeared by the sixth day that the patient felt comfortable. On the eleventh day the dose of adrenalin was reduced to 10 drops, and this was continued for nine days. The patient's condition became practically normal, she was able to take nourishment and gained in weight, and the ovum grew in a normal manner. Later the patient had a recurrence of the nausea and other symptoms, which ceased after five administrations of 10 drops of the solution daily. The fact that the patient was fed by the rectum, and given small doses of opium by the same method, makes it doubtful whether the adrenalin was the potent agent in the patient's recovery. So many of these cases improve if life can be supported for a few weeks that it is difficult to decide that adrenalin alone was the potent agent in the patient's recovery.

The Surgical Treatment of Puerperal Sepsis.—KOBLANCK (*Zentralbl. f. Gynäk.*, No. 46, 1909) gives the results of treatment in 484 cases of puerperal sepsis, of whom 100 had severe infection. It was impossible to divide these cases into typical septicemia and pyemia. In 34 cases treatment was satisfactorily carried out by collargol.

Puerperal septic peritonitis was observed in three varieties: One followed perforation, the active agent being Bacillus coli communis, with symptoms of pronounced distention and great tenderness of the abdomen.

These cases gave a fairly good prognosis if operation was quickly performed. One of these patients treated by abdominal total extirpation of the uterus recovered; two others not operated upon died.

The second variety of infection was that which developed gradually with the formation of encapsulated pus. The rapidly increasing leukocytosis was significant in forming the diagnosis. In many of these patients the abdomen was not distended, nor especially painful. Of the three cases operated upon, one of these recovered.

The third variety of sepsis could be entitled the fulminant sort in which the infection arose usually through the genital organs, and rarely from a focus without the genital tract. In these cases not only must the peritonitis be treated, but the infected condition of the uterus also demands attention.

In five of these patients operated upon, one recovered. One of these patients suffered from angina in addition to the septic infection.

In operating upon these cases, not only must the abdomen be opened for drainage, but the operator must separate adherent intestines and omentum, wash out or sponge out the pus, make counter openings, and irrigate through these openings for complete drainage. Good results were obtained by continuous irrigation with warm salt solution through the openings for drainage.

In treating suppurating thrombophlebitis it is important to diagnosticate the condition as early as opossible. The diagnosis is made more certain by reference to the leukocyte count, which in these cases approaches more nearly the normal than in cases of parametritis and peritonitis. Ligation of the thrombosed veins and broad ligaments seems to influence the course of the disease in four ways—it prevents the extension of the thrombus to the vena cava, prevents the distribution of minute thrombi through the circulation, limits the infection to the uterus, and prevents the spread of bacteria.

Koblanck does not think it sufficient to simply ligate the veins, but believes it necessary to remove purulent foci as well. This was performed in 6 cases of extirpated thrombosed veins, removing as much as possible of the infected parametrium, tubes, and ovaries, and the infected tissue of the uterus as well. Two of these patients recovered.

This operation is indicated only in those cases in which the body of the uterus seems to be healthy. Unless this is the case the uterus must be extirpated. In 3 fatal cases autopsy showed that the leaving of the uterus had been a mistake.

In 15 cases the extirpation of the septic uterus was practised, with 6 recoveries, and 9 deaths.

Indications for operation were uterine infection with hemolytic streptococci. Contra-indications for the operation were metastases in

the heart, lungs, and eyes, as in these cases recovery is exceptional. In 19 patients having septic lesions of the heart, but 2 recovered; in 8 septic cases with ocular complications, but 1 recovered; in 55 septic cases with septic lesions of the lungs or pleuræ, but 9 recovered. The general resisting power of the patient is of great importance in these cases.

Cases operated upon by total extirpation were divided into those where general infection was present, and those patients in whom the first symptoms of general infection were discernible.

In the first class, 11 operations were performed, and of these, 2 had general peritonitis, 5 thrombophlebitis with phlegmonous inflammation of the pelvic connective tissue, 3 parametritis and abscess in the broad ligament, while 1 had general septic infection without a clearly defined localized focus, but with abundant streptococci in the blood. Of these 11 patients, but 3 recovered.

In the second group there were 4 cases—3 in which the infection seemed to be limited to the uterus, and 1 with general peritonitis, apparently spreading from the uterus. All of these recovered.

In these cases it may be impossible to say that the patient would not have recovered without operation in some.

Vaginal extirpation may be chosen in threatened general infection where the uterus at the time of operation seems to be the principal focus. In all other cases abdominal section must be practised and the operation suited to the lesions which are found.

GYNECOLOGY.

UNDER THE CHARGE OF

J. WESLEY BOVÉE, M.D.,

PROFESSOR OF GYNECOLOGY IN THE GEORGE WASHINGTON UNIVERSITY, WASHINGTON, D. C.

The Surgical Treatment of a Most Frequent Cause of Dysmenorrhœa and Sterility in Women.—S. Pozzi (*Surg., Gyn., and Obst.*, 1909, ix, 111) described to the American Gynecological Society an operation he has devised for dysmenorrhœa and sterility in women. The operation is limited to nulliparous women suffering from "cervical metritis due to stenosis." Pozzi terms the operation "stomatoplasty by commissural evidement." The technique of the operation is thus briefly described: The cervix is exposed and grasped anteriorly and posteriorly by bullet forceps. It is next dilated by Hegar's dilators up to number 20 or 30; after bilateral discission of it to a distance of 2 or 3 c.m., curettage with an intra-uterine aseptic flushing is followed by an injection of perchloride of iron, and that by another aseptic injection. Then comes the principal part of the operation. A navicular piece of tissue is next removed from each lateral denuded surface and the cervical mucosa and vaginal surface are united over the excavation by interrupted sutures,

while the anterior and posterior flaps are widely separated. The denuded surfaces closely resemble those denuded from trachelorrhaphy, but the flaps are kept apart instead of being sutured together. The middle suture at the bottom of each sulcus is the first one tied. Pozzi claims splendid results from this procedure.

The Mechanism of Occlusion of the Fallopian Tube.—Emil Ries (*Amer. Jour. Obst.*, 1909, lx, 201) commented at length on the literature of this subject and presented two illustrative specimens to the Chicago Gynecological Society. He declares there is very satisfactory argument as to the actual observations of this condition, but that differences arise in the interpretation of these facts, the main difficulty arising over the mechanism which causes the fimbriated ends to turn from their normal condition to that found in occlusion, a turn of apparently 180 degrees. Ries suggests that the peritoneum surrounding the fimbriæ becomes inflamed and contracts, forming a non-elastic ring. The subsequent distention of the tube, followed by relaxation incident to absorption of its contents, permits the ring to contract further. The fimbriæ, being covered by epithelium, do not adhere to the ring and escape inwardly.

Chronic Inversion of the Uterus.—Sealy (*Amer. Jour. Obst.*, 1909, lx, 284) records a case of inversion of the uterus for two years and four months duration cured by posterior colpotomy and posterior uterine section. The cervix was first medially split posteriorly, and then the peritoneum was opened. The uterine incision was by gradation finally extended to the fundus, as taxis failed to produce reduction with shorter ones. A finger introduced from behind into the abnormal uterine cavity was a valuable guide. Sealy claims for this method of procedure that it is easy, comparatively safe, and absolutely successful regarding reduction of the inversion.

Suprapubic Operation upon the Pelvic Floor for Prolapse of the Uterus.—W M. Polk (*Amer. Jour. Obst.*, 1909, lx, 418) recommends for extreme prolapse of the uterus and bladder the following procedure: After a limited preliminary treatment, including rest in bed, to improve the local and general condition of the patient, the usual median line incision is made through the lower abdominal wall and the patient's position changed to that of Trendelenburg. The pelvis is carefully emptied of omentum and intestines, except the sigmoid and rectum. With a tenaculum the uterus is grasped at its junction with the anterior peritoneal reflection and traction made; the bladder is drawn well forward and an incision is made in the median line from the tenaculum forward and downward to the urethra and the vaginal wall without opening the latter. Avoiding the ureters and uterine arteries as well as the vagina, the fascia is brought in toward the median line by means of one tier of continuous deep suturing; another layer of similar suturing draws in all slack tissue on either side. The uterosacrals are shortened next. The abdomen is now closed. If the uterus should be amputated, it is done at the level of the internal os before the anterior incision is made, and the stumps of the broad and round ligaments are subsequently sutured to the top of the cervix and the uterosacrals sutured over on

top of them, perhaps crossing each other. In some instances in which the uterus is to be retained the round ligaments may need shortening. Rectocele and peritoneal lacerations may be then or later properly treated.

Fever in Cases of Myoma Uteri.—Otto V. Franque (*Ztschr. f. Geburtsh. u. Gynäkol.*, 1909, lxiv, Heft 3, 449) has observed the occurrence of fever in many cases of uterine myomas which could be attributed to (1) an aseptic necrosis of the tumor, (2) a bacterial infection of the growth by way of the blood stream, (3) thrombosis and phlebitis, and (4) a coincident salpingitis. In such cases the fever may be the only indication of a complication, and therefore clinical observations for several days should always precede severe operations for myomas. He holds that complete necrosis of myomas during pregnancy is much more common than heretofore believed, and that as such conditions are very favorable to local infection, the occurrence of fever during the puerperium in cases of uterine myomas should suggest an early operation to prevent the appearance of severe septic symptoms.

Extension of Uterine Adenomyomas to the Rectum.—Anton Sitzenfrey (*Ztschr. f. Geburt. u. Gynäkol.*, 1909, lxiv, Heft 3, 538) has studied four cases of involvement of the rectum by so-called adenomyomas of the uterus, and from his own observations and a review of the literature concludes that genuine adenomyomas very rarely extend from the uterus to the rectum. He believes that growths involving both organs are, as a rule, adenomas with an accompanying myositis of the rectum rather than true adenomyomas, though he considers it possible for the adenoma element to extend from the uterus to the rectum and there set up an inflammatory reaction, which in turn may result in the development of a true adenomyoma, the myoma element being derived from muscular tissue of the rectum. The distinction between an inflammatory infiltration of the rectum and the presence of a tumor is of great importance from the standpoint of operation, as in the first case the removal of the primary growth in the uterus causes a disappearance of the enlargement in the rectum, while in the latter case a resection of the rectum is indicated. In many cases it is not possible to distinguish at the time of operation between adenomyoma or adenomyositis and carcinoma.

What is the Preferable Time for Abdominal Operation for a Chronic Inflammatory Mass in the Pelvis.—H. S. Crossen (*Surg., Gyn., and Obst.*, 1909, ix, 405) states that in more than half of the cases of chronic suppuration in the pelvis the pus is sterile at the time of operation, showing that sterilization of the infected focus takes place automatically within a reasonable time in the majority of cases. Crossen emphasizes the markedly greater safety in the abdominal removal of the mass after, instead of before, the death of the bacteria. He cautions against abdominal operations for such conditions caused by the streptococcus, even though the pulse and temperature have become normal. It is especially recommended that the variety of infecting organism be learned, if possible, before operation. For determining this point good working rules are given.

Final Word on the Stem Pessary for Amenorrhœa, Dysmenorrhœa, Sterility, Etc.—J. H. CARSTENS (*Jour. Amer. Med. Assoc.*, 1909, liii, 1730) has written a fourth paper on the subject of the use of the stem pessary for various uterine functional abnormalities. For amenorrhœa, premature atrophy, dysmenorrhœa, displacements of the uterus, and sterility He strongly recommends the application of the stem pessary. In some instances its retention for one to two years is advised. He regards pelvic inflammations as contra-indicating the use of the stem pessary.

DERMATOLOGY.

UNDER THE CHARGE OF

LOUIS A. DUHRING, M.D.,

PROFESSOR OF DERMATOLOGY IN THE UNIVERSITY OF PENNSYLVANIA,

AND

MILTON B. HARTZELL, M.D.,

ASSOCIATE IN DERMATOLOGY IN THE UNIVERSITY OF PENNSYLVANIA.

Lupus or Tertiary Syphilis? Sarcoma or Primary Syphilis?—Under this heading A. NEISSER (*Berl. klin. Woch.*, August 16, 1909) discusses the differential diagnosis, giving the notes of a case of supposed lupus in which existing syphilis was not diagnosticated for two years. When there exists a suspicion of syphilis, he advises energetic mercurial and iodide treatment. Nasal disease first manifesting itself in a woman as late as the age of forty-one is more likely to be syphilis than lupus. A negative history, especially in women, does not exclude syphilis. The author advises the employment of the subcutaneous tuberculin test in all instances of a superficial disease suspected of being tuberculosis. A case is cited in which a large red warty patch had been observed for two years on a young man and the diagnosis of tuberculosis verrucosa made, but no reaction followed tuberculin up to 5 mg., but the Wasserman test proved that syphilis existed, and recovery followed the usual internal remedies. A case is referred to in which a woman was believed to have a sarcoma of the uterus, the microscopic examination pointing to that disease, and hysterectomy was performed. Later, a papular syphilodeum appeared. The Wassermann test before the operation would have indicated the necessity for an antisyphilitic treatment.

Experimental Studies Concerning Tuberculosis of the Skin.—LEWANDOWSKY (*Archiv f. Dermat. und Syph.*, 1909, xcviii, Heft 2 and 3), who has made a somewhat extensive study of the results following the inoculation of human and bovine tubercle bacilli into the skin of rabbits and guinea-pigs, has found that such inoculation when properly performed always leads to a local tuberculosis of the skin. The result of the inoculation is dependent upon the varying virulence of the strain of the bacilli employed and upon racial and individual differences of the

animals inoculated. The typical inoculation ulcer appears in guinea-pigs only in the second week, and may last until the death of the animal or it may heal over. In the latter event the small red-brown discolored spot remaining still contains tuberculous tissue and is inoculable. Tuberculosis of the lymph cords only appears after the lymph-glands in the neighborhood are affected, and this may lead to the formation of nodules with crateriform ulcers which only heal in the last days of the animal's life. In rabbits, in addition to ulcers, inoculation produces foci similar to lupus or, according to location, tuberculosis verrucosa. Intravenous injections into the engorged ear of the rabbit may produce a papular eruption on the skin of the ear, which undergoes spontaneous involution and contains bacilli only in the beginning (tuberculide-like lesions). After similar injections with bovine bacilli a true tuberculosis occurs. Infection of the skin with bovine bacilli leads in rabbits always to general tuberculosis, but infection with human bacilli pursues a different course; even intravenous injection is not always followed by general tuberculosis. Of internal organs, the lungs are almost always affected in rabbits after cutaneous infection. Histologically caseation is almost always wanting in the skin. In animals which have undergone a cutaneous inoculation, subsequent inoculations, if they are made some time after the first one, take effect less vigorously than the first, unless the later ones are made with bovine bacilli. This relative immunity of the skin also appears after intraperitoneal inoculation.

Dermatitis Herpetiformis.—Bogrow (*Archiv f. Dermat. und Syph.*, 1909, xcviii, Heft 2 and 3) reports a case of dermatitis herpetiformis with extensive eruption which, beginning acutely in a woman with carcinoma uteri, began to undergo regression coincidently with the employment of disinfecting vaginal douches, the internal administration of calcium chloride, and the local use of astringent salves and compresses. An abrupt ending of the cutaneous affection and fall in the elevated temperature followed immediately upon an operation in which the entire visible, partly necrotic mass of the tumor was removed. Recurrence of the growth, which caused the death of the patient, was not followed by a return of the eruption. The author regards the case as a toxidermia proceeding from the necrotic tumor of the uterus, from which bacterial products reached the circulation, a view which the results of treatment support. Should future observations of a similar nature be made, the author believes they would furnish ground for more closely associating dermatitis herpetiformis and impetigo herpetiformis.

The Treatment of Itching Dermatoses, Especially Trade Eczema, with Undiluted Coal Tar.—Chajes (*Dermat. Ztschr.*, 1909, xvi, Heft 9), who has employed coal tar in the treatment of 64 cases of various diseases of the skin, such as eczema, lichen planus, prurigo, and pruritus hiemalis, finds that it is an excellent and quickly acting remedy in many acute and chronic itching affections, being especially valuable in the treatment of those eczemas occurring in workers in various trades. It lessens itching, diminishes redness and swelling, and dries up and heals oozing eczemas. It is contra-indicated in infection of the skin, since suppuration can take place and spread under the coal tar. The method of application is quite

simple, consisting in applying a moderately thick layer of the tar to the affected area with a not too stiff brush, previous cleaning being necessary only in those cases attended by abundant exudation and the consequent formation of thick crusts.

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

WARFIELD T. LONGCOPE, M.D.,

DIRECTOR OF THE AYER CLINICAL LABORATORY, PENNSYLVANIA HOSPITAL,

ASSISTED BY

G. CANBY ROBINSON, M.D.,

CLINICAL PATHOLOGIST TO THE PRESBYTERIAN HOSPITAL, PHILADELPHIA.

The Action of Leukocytic Extracts on the Course of Pneumonia.—The idea that leukocytes contain substances which, when present in a free state, might have a beneficial effect upon infectious processes originated with Hiss. His hypothesis was that the phagocytic cells contain an anti-endotoxin which protected the cells against the endotoxins of the bacteria which had been ingested. If this anti-endotoxin was liberated in a free state it would have a beneficial effect in the animal suffering from an infective process. This hypothesis was put to extensive experimental investigation by Hiss and Zinsser (*Jour. Med. Research*, 1908, xix, 323) by injections of leukocytic extracts into animals after they had been inoculated with various pathogenic bacteria. This procedure gave such good results in effecting favorably the course of the infections in animals that it seemed justified to use the method as a means of treatment in human infectious processes. This method has been used in man by Hiss and Zinsser, who have made, besides their original report, a second one on the treatment of staphylococcus infections with leukocytic extract (*Jour. Med. Research*, 1909, xx, 506). It has also been employed by Lambert (Amer. Jour. Med. Sci., 1909, cxxxvi, 506) in a variety of infectious processes in man. But the most extensive employment of this method of treatment in any one disease is that reported by Floyd and Lucas (*Jour. Med. Research*, 1909, xxi, 223), who used leukocytic extract as a method of treatment in 41 cases of pneumonia. Leukocytes were obtained from young rabbits after injections into the pleural and abdominal cavities of 10 c.c. of a 5 per cent. aleuronat solution. The exudate thus obtained was washed and centrifuged, the leukocytes were broken up by beating with a platinum loop, and extracted with distilled water. Ten c.c. subcutaneously injected twice a day was the standard dose. As much as 20 c.c. three or four times a day was given without any harmful effects. There were five deaths in these cases, giving a mortality of 12.5 per cent., which is to be contrasted with a mortality of 21 per cent. occurring in cases of pneumonia treated by other methods under the same general conditions. All of the cases treated were lobar in type except three, which were cases of bronchopneumonia. Of the 5 cases that died, 2 were

of bronchopneumonia in children. Of the 3 fatal adult cases of lobar pneumonia, 2 had heart lesions and 1 was a man aged seventy years. What seems to be the most striking result is, however, that in 44 per cent. of the treated cases the crisis occurred on or before the sixth day. No bad effects were seen, and the benefit obtained from the treatment is strikingly seen when some of the individual cases are considered.

The Diagnosis of Cancer of the Stomach by Salomon's Test and by the Hemolysin Method.—In 1903 SALOMON (*Deut. med. Woch.*, 1903, xxxi) published a test for the diagnosis of cancer of the stomach based on the fact that due to the carcinomatous degenerated stomach wall the stomach washings of such cases contained more albumin than those of normal stomachs. The procedure consists in washing out the stomach the evening before the test, and then washing it again in the morning with 400 c.c. of normal salt solution. From 100 c.c. of this wash water the nitrogen content is estimated by the Kjeldahl method and the albumin with Esbach's reagent. A result of more than 20 mg. of nitrogen and a cloudy Esbach reaction are considered to point strongly toward carcinoma, though the results are vitiated if there is excessive mucus present. This can be prevented by previously separating the mucus out by acetic acid. Non-ulcerating carcinomas may also give negative results; and positive results may be obtained in non-carcinomatous cases if the stomach is primarily not completely washed out or if there is ulceration from other causes. Reicher showed that the nitrogen came from the nucleo-albumin of the tumor cells rather than serum-albumin, and recently GOODMAN (*Univ. of Penna. Med. Bull.*, May, 1909) has found that the phosphates in the stomach washings of carcinomatous cases usually exceeded 10 mg. per 100 c.c., while in non-carcinomatous cases they were below 10 mg.

Last year GRAFE and ROHMER (*Deut. Archiv f. klin. Med.*, 1909, xciii, 161) elaborated another method depending on the presence of lipoid substances in the carcinomatous stomach wall, which can be demonstrated in the stomach contents by their strong hemolytic action. The technique is as follows: The fasting stomach is washed and emptied, and a test meal given. The filtrate of the stomach contents obtained one hour after the test meal is made faintly alkaline to litmus and an equal amount of ether is added. It is shaken for twelve hours and the ethereal extract removed and evaporated. The residue is then so emulsified in normal salt solution, that 1 c.c. of the salt solution represents 10 c.c. of the stomach contents. It is added to an equal amount of a 5 per cent. mixture of freshly washed rabbit corpuscles, and brought up to 3 c.c. with salt solution. After three hours in the thermostat, shaking up once or twice, it is left in the ice chest over night. Only those stomach contents should be considered positive in which there is complete hemolysis, a brownish discoloration denoting an insufficient amount of alkali.

ROSE (*Deut. Arch. f. klin. Med.*, 1909, xcv, 518) has compared the two methods in 37 cases, with the following results: In 8 cases of certain carcinoma both tests were positive; in 22 cases other than carcinoma both tests were negative. In one case of extreme gastroptosis both tests were positive, the Salomon test because of mucus and bile in the stomach contents, the hemolysin because of the backflow of the

pancreatic juice. In one case of ulcer of the stomach in which there had been a hemorrhage within a month, the hemolysin test was positive, the Salomon negative. In one that subsequently proved to be a carcinoma of the gall-bladder, the Salomon test was positive, the hemolysin negative. Rose believes that in cases in which there is an extensive ulceration a negative Salomon test points to a benign ulcer, even if the hemolysin test is faintly positive. In gastroptosis, which seems to be the commonest source of error, a positive hemolysin test with a negative trypsin content admits of a diagnosis of malignancy. Rose considers both tests to be equally valuable, though from neither can an absolutely certain diagnosis be made.

Hemolytic Jaundice.—MARCHIAFAVA and NAZZARI (*Bull. della Reale Acad. Med. di Roma*, Fasc. 3, 1909) divide cases of hemolytic jaundice into those running acute and chronic courses. Examples of the former occur in poisoning by hemolytic substances and in malaria, whether simple or complicated by hemoglobinuria. In these forms of jaundice the feces are deeply colored, bile pigment is often lacking in the urine, which may contain urobilin or hemoglobin, and microscopically, granular casts or masses of hemoglobin and epithelial casts with protoplasm stained with hemoglobin. At autopsy, the liver is enlarged, congested, rich in bile; while the gall-bladder is turgid with thick, dark bile and the duodenum is bile-stained. Microscopically, the liver cells do not show greater changes than in other malarial infections. The epithelium of the renal tubules is infiltrated with hemoglobin or pale yellow granules. The hemolytic jaundice with a chronic course may be either acquired or congenital. The congenital form is less severe, and in them the icterus outweighs the anemia. In the more severe acquired forms the anemia outweighs the icterus, and the patient presents the picture of pernicious anemia. From observation of a typical case of each kind and a survey of others reported in the literature, Marchiafava and Nazzari offer the following facts in favor of the hemolytic origin of the jaundice: the anatomical integrity of the liver accompanied by a polychromic polycholia (observed intra vitam during operation for cholecystostomy); the progressive diminution of the number of red blood cells; the almost continuous elimination in the urine of blood pigment in solid form, with crises of hemoglobinuria and urobilinuria, the presence in the blood cells of the granules of degeneration; finally the analogy with the symptoms of other hemolytic affections, whether spontaneous (as idiopathic or malarial hemoglobinuria) or provoked experimentally in animals by means of hemolytic poisons.

Notice to Contributors.—All communications intended for insertion in the Original Department of this JOURNAL are received only *with the distinct understanding that they are contributed exclusively to this* JOURNAL.

Contributions from abroad written in a foreign language, if on examination they are found desirable for this JOURNAL, will be translated at its expense.

A limited number of reprints in pamphlet form, if desired, will be furnished to authors, *provided the request for them be written on the manuscript.*

All communications should be addressed to—

DR. A. O. J. KELLY, 1911 Pine Street, Philadelphia, U. S. A.

CONTENTS.

ORIGINAL ARTICLES.

Vaccine Therapy in Colon-bacillus Infection of the Urinary Tract . . 625
By Frank Billings, M.D., Professor of Medicine in the Rush Medical College, in Affiliation with the University of Chicago.

Paroxysmal Arteriospasm with Hypertension in the Gastric Crises of Tabes 631
By Lewellys F. Barker, M.D., Professor of Medicine in the Johns Hopkins University, and Physician-in-Chief to the Johns Hopkins Hospital, Baltimore.

A Study of Five Hundred and Fifty Cases of Typhoid Fever in Children 638
By Samuel S. Adams, A.M., M.D., Professor of the Theory and Practice of Medicine and of Diseases of Children in the Georgetown University, Washington, D. C.

Arterial Hypertension 648
By Arthur R. Elliott, M.D., Professor of Medicine in the Postgraduate Medical School, Chicago.

The Use and Abuse of Gastro-enterostomy 655
By John B. Deaver, M.D., LL.D., Surgeon-in-Chief to the German Hospital, Philadelphia.

Have We Made Any Progress in the Treatment of Gonorrhœa? . . 664
By L. Bolton Bangs, M.D., Consulting Surgeon to the Bellevue and St. Luke's Hospitals, New York.

Helminthiasis in Children 675
By Oscar M. Schloss, M.D., Assistant to the Chair of Pediatrics in the New York University and Bellevue Hospital Medical College; Assistant Visiting Physician to the Out-patient Department of the Babies' Hospital, New York.

An Epidemic of Noma 705
By Harold Neuhof, M.D., Adjunct Surgeon to the New York Hebrew Infant Asylum.

The Antitryptic Activity of Human Blood Serum: Its Significance and Its Diagnostic Value 714
By Richard Weil, M.D., of New York.

The Wassermann and Noguchi Complement-fixation Test in Leprosy 725
By Howard Fox, M.D., of New York.

The Effect of Tuberculosis on Intrathoracic Relations 732
By Albert Philip Francine, A.M., M.D., Instructor in Medicine in the University of Pennsylvania.

REVIEWS.

The Principles of Pathology. Vol. I. General Pathology. By J. George Adami, M.D., LL.D., F.R.S. Vol. II. Systemic Pathology. By J. George Adami and Albert G. Nicholls, M.A., M.D., D.Sc., F.R.S. (Can.) 745
A Text-book of Physiological Chemistry for Students of Medicine. By John H. Long, M.S., Sc.D. 749
Chemical and Microscopical Diagnosis. By Francis Carter Wood, M.D. . 750
Lehrbuch der klinischen Diagnostik innerer Krankheiten. Edited by Paul Krause, M.D. 750
Cataract Extraction. By H. Herbert, F.R.C.S. 751
A Text-book of Diseases of the Ear. By Macleod Yearsley, F.R.C.S. . . 752

PROGRESS OF MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

WILLIAM OSLER, M.D., AND W. S. THAYER, M.D.

The Effect of Digitalis on the Ventricular Rate in Man 753
Auricular Fibrillation 754
The Etiology of Beri-beri 754
The Physiology of the Immediate Reaction of Anaphylaxis 755
Jaundice in Pneumonia 756
On the Quantity of Glycuronic Acid in the Urine in Health and Disease . 756
The Cultivation of the Organism of Infantile Paralysis 756
Rat-bite Fever 757
"Nail-palpation" of the Arterial Wall 757
A Previously Undescribed Symptom of Tetany 758

SURGERY.

UNDER THE CHARGE OF

J. WILLIAM WHITE, M.D., AND T. TURNER THOMAS, M.D.

Atlo-axoid Fracture Dislocation 758
Malignant Degeneration of Benign Diseases of the Breast 759
The Treatment of Cystitis, Especially Severe Postoperative Cases . . . 759
The Operative Treatment of Wounds of the Lungs 760
Stasis Hemorrhages Resulting from Compression of the Thorax and Abdomen 761
An Experimental and Literary Study Concerning the Manner and Pathway of Extension of Urogenital Tuberculosis 761
The Treatment of Bone and Joint Tuberculosis by the *X*-rays 762

THERAPEUTICS.

UNDER THE CHARGE OF

SAMUEL W. LAMBERT, M.D

Diet in Typhoid Fever 763
Antidiphtheritic Serum and Antidiphtheritic Globulin Solutions . . . 764
Tuberculin Treatment of Tuberculosis 764
The Treatment of Gastroptosis 765
The Treatment of Gastric Disease with Aluminum Silicate 765
Substitutes for Digitalis 766
The Treatment of Acute Pulmonary Œdema 766
Chloral Hydrate as a Local Application 766

PEDIATRICS.

UNDER THE CHARGE OF

LOUIS STARR, M.D., AND THOMPSON S. WESTCOTT, M.D.

Unusual Persistence in the Secretion of Colostrum 767
Dried Milk as a Food for Infants 767
Cyclic or Recurrent Vomiting with Hypertrophic Stenosis of the Pylorus . 768
An Epidemic of Acute Poliomyelitis 769
The Dwarf Tapeworm, an Intestinal Parasite in Children 769

OBSTETRICS.

UNDER THE CHARGE OF

EDWARD P. DAVIS, A.M., M.D.

The Diagnosis of Puerperal Septic Infection 770
Modification of Peripheral Sensation during Pregnancy 771
Ovariotomy and Myomectomy Early in Pregnancy, with Full Term Delivery 771
Ovarian Cyst with Twisted Pedicle Complicating Pregnancy 771
Artificial Reproduction of the Amniotic Liquid during Labor 772
The Results of Pregnancy Occurring after Operation for the Correction of Retroflexion 772

GYNECOLOGY.

UNDER THE CHARGE OF

J. WESLEY BOVÉE, M.D.

An Ovarian Abscess Containing a Lumbricoid Worm 772
The Choice of Operations for Retrodisplacements of the Uterus . . . 773
The Endometrium and Some of its Variations 773

Factors which Contribute to a Reduction in Mortality in Abdominal Surgery 773
The Age of Menstruation in Egyptian Girls 774
The Anatomy of Tubal Convolutions and the Mechanism of Tubal Occlusion 774
Removal of an Unusually Large Ovarian Tumor 774
Enucleation of Uterine Myomas; Why and When Performed 774

OPHTHALMOLOGY.

UNDER THE CHARGE OF

EDWARD JACKSON, A.M., M.D.,

AND

T. B. SCHNEIDEMAN, A.M., M.D.

The Treatment of Detachment of the Retina 775
Myopia and Light Sense 776
Report upon 103 Cases of Magnet Extraction 776
Etiology of Subacute and Tardy Infection Following Operations . . . 776
Nervous Asthenopia from Electric Light; Use of Yellow Glasses . . 777
Trachoma in the Abruzzi, Italy 777
Subcutaneous Injections of Alcohol in Blepharospasm and Spastic Entropion 777
Helmholt's Theory of Accommodation 777

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

WARFIELD T. LONGCOPE, M.D.,

ASSISTED BY

G. CANBY ROBINSON, M.D.

The Nature ofAntitrypsin in the Blood Serum and its Mode of Action . . 778
The Venous Pulse under Normal and Pathological Conditions . . . 778
The Cause of Arteriosclerosis 779
Changes in the Chromaffin System in Cases of Unexplained Postoperative Death 780